SCIENTIFIC AMERICAN

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BRIDGING THE HUDSON AT POUGHKEEPSIE.

A glance at any map of the Eastern and Middle States will show the need of a bridge over the Hudson River at a point midway between New York and Albany. All traffic between the New England States and the West and South over either of the lines having a terminus at Jersey City is subjected to more or less delay, caused by crossing the Hudson at that point. The Poughkeepsie bridge, together with about twelve miles of road to be built between Poughkeepsie and Gardiner, will obviate this difficulty by making an almost direct route from Boston and Springfield to Scranton and the anthracite coal fields and Harrisburg. The advantages to be derived by the transportation of coal over this route, and by the passenger and freight traffic between New England and the West and South, are apparent.

The Poughkeepsie bridge has four piers in the river. These are of masonry resting upon timber caissons, which are dredged down to about 125 feet below high water. These caissons are 60 feet by 100 feet, with twelve pockets left open for dredging, and which will be filled with concrete after the caissons are sunk. The masonry will be built on grillages, 46 feet by 100 feet by 10 feet deep, with temporary sides. These will be sunk to rest on the top of the caissons, which will be 20 feet below high water. The masonry piers are 24 feet thick and 86 feet long, and their tops will be 30 feet above high water. From that level to the lowest point of the superstructure—100 feet—will be steel towers, 16 feet by 60 feet on the base and 16 feet by 30 feet on top, made of eight columns well braced together in all directions. The wind pressure provided against is 30 pounds per square foot upon the exposed surface of the spans and towers and the area of the trains. The spans are provided to carry a train load of 3,000 pounds on each track, headed by two consolidation locomotives of 85 tons each, with factor of safety of 5. The pressure on the caisson bases is about 3 tons per square foot, and the material upon which they rest is hard gravel. The principal changes from the original plan of this bridge, as designed some 15 years ago, are, substitution of steel towers for masonry, which diminishes the pressure on foundations very much; substitution of three cantilever spans of 548 feet each and two connection spans of 525 feet each for five disconnected spans of 525 feet each. This change enables the Union Bridge Company to erect the three cantilever spans without staging in the river. It also gives more waterway between the piers, and a clear height of 160 feet instead of 130 feet in three spans.

The superstructure will embody all the results of the latest and best practice. The following is a record of the test of an eyebar similar to those to be used in this bridge:

Ultimate strength, 66,445 lb. per square inch.

Elastic limit, 36,063 lb. per square inch.

Elongation in 8 ft., 21 per cent.

Elongation in 12 in. at point of fracture, 37½ per cent.

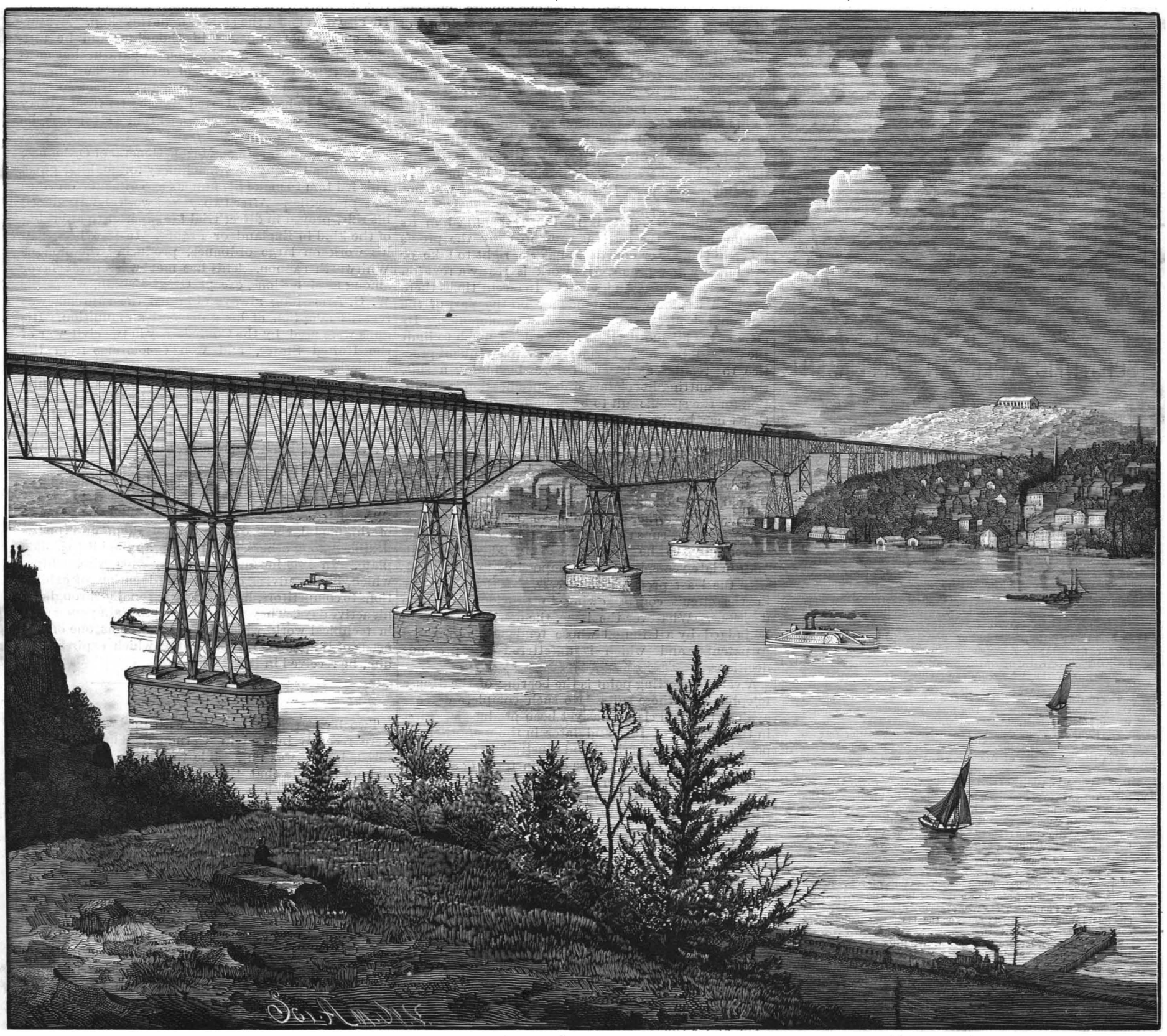
Reduction of area at point of fracture, 51 per cent.

All broke in the body of the bar.

These were tested on the Union Bridge Co.'s 600 ton testing machine at Athens, Pa., at present the most powerful testing machine in the world.

It is expected to pass trains over this bridge before December 31, 1887. When it is considered that the

(*Continued on page* 84.)



THE POUGHKEEPSIE BRIDGE OVER THE HUDSON RIVER.

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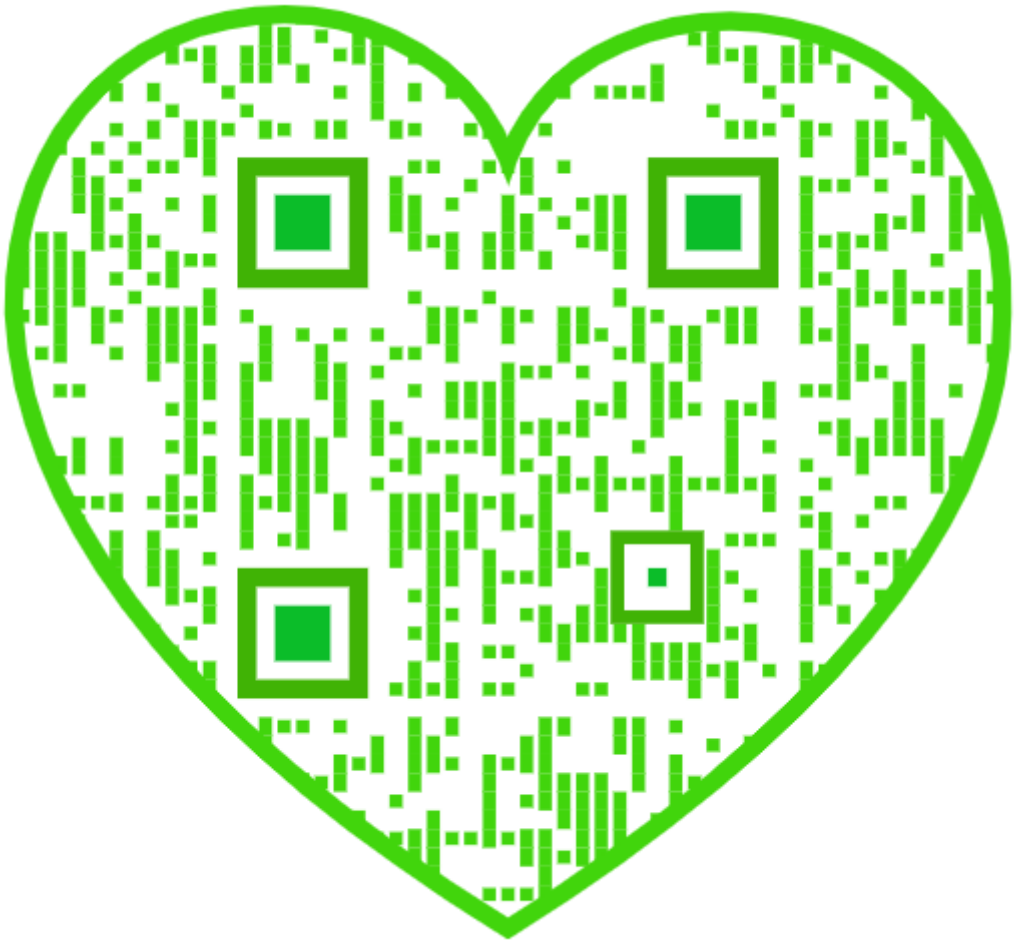

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NEW YORK, SATURDAY, FEBRUARY 5, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

Algaborilla..... 85
Ashes, analyzed the..... 80
Bicycle, swing, Brown's*..... 87
Birds' nests and eggs..... 85
Bridge over the Hudson River at Poughkeepsie*..... 79, 84
Business and personal..... 91
Car brake, improved*..... 88
Chemical experiments, simple*..... 90
Clock, multitudinous..... 86
Comet *a*, 1887 (Thome)..... 81
Comet Brooks No. 1 of 1887..... 85
Comet, new, discovery of..... 85
Diamond, the, formation..... 86
Draughts, beware of..... 85
Dynamite, explosive effects of..... 85
Engine, spring wheel traction*..... 86
Fibers, separating..... 88
Fish, small, that swallows a larger fish*..... 87
Fishes, some new*..... 87
Harness, backband for*..... 83
Inventions, agricultural..... 91
Inventions, engineering..... 91
Inventions, index of..... 91
Inventions mechanical..... 91
Inventions, miscellaneous..... 91
Inventor, the, honor..... 84
Inventors, a chance for..... 84
Jeweler, ideal, the..... 88
Lathe for amateurs and light shop work*..... 82
Music baton, electrical*..... 82
Notes and queries..... 91
Officers, change of..... 81
Oil, drop, how to cleanse..... 81
Papier mache..... 81
Photography, orthochromatic, yellow glass panes in, substitute for..... 88
Pipe reel, lead, improved*..... 83
Pipes, waste, clearing..... 88
Pliers, gas, improved*..... 83
Railway rail joint, improved*..... 88
Railways, English, Beecher on..... 90
Railways, wooden, of the U. S..... 81
Roach, John, pet ambition of..... 81
Rock drilling machine, duplex, Ingersoll*..... 83
Snake, poisonous, another, in Pennsylvania..... 85
Steel works, Krupp's and Carnegie's..... 85
Stone, Charles P., Gen..... 84
Stove, balanced cooking, for ships*..... 83
Telephone suits, Bell..... 80
Telephone wires, improved..... 87
Toys, science in*..... 89, 90
Tubes, device for trimming the ends of*..... 82
Wheels, spring, for traction engines*..... 86
Whitworth, Sir Joseph..... 80

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 579.

For the Week Ending February 5, 1887.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ELECTRICITY.—Gray's Standard Galvanometer.—A reflecting galvanometer with a long solenoid for fixing the field.—Its formula, construction, and operation.—1 illustration..... 9247

The New Sextuplex Telegraph.—Mr. Stephen D. Field's new system fully described.—3 illustrations..... 9246

II. ENGINEERING.—The Meigs Elevated Railway.—The new system of railroad.—Described at length.—Engineer Geo. Stark's report on the same.—6 illustrations..... 9239

III. GEOLOGY.—The Muir Glacier.—By G. FREDERICK WRIGHT.—Elaborate account of the great Alaska glacier.—Its surroundings and general features.—Its velocity.—The temperatures and flora of the region.—2 illustrations..... 9252

IV. MISCELLANEOUS.—Method of Breaking Glass Tubes.—By ERNST BECKMANN.—A simple and certain method of cutting glass tubing..... 9254

Necklaces of Hazel Nuts.—A curious method of stringing nuts upon human hair.—1 illustration..... 9254

The British Life Saving Rocket Service.—The system in use on the coast of Great Britain.—The rockets, coil box, whip block, wagon, ladder, helmet, etc., described.—16 illustrations..... 9239

The Fading of Water Colors.—Thesubject treated with reference to mineral colors especially.—Note by ARTHUR RICHARDSON..... 9249

The Gas Companies of America.—By WM. W. GOODWIN.—Full statistics of this industry.—Price of gas per M.—Amount sold.—How made and quantity of coal used, etc..... 9242

V. PHOTOGRAPHY.—Photography of Moving Objects, and the Study of Animal Movements by Chrono-Photography.—By E. J. MAREY.—An elaborate exposition of Prof. Marey's experiments on animal motion; the report of a recent lecture; the motions of horses and men.—17 illustrations..... 9243

VI. PHYSICS.—An Apparatus for Maintaining Constant Temperatures up to 600 Degrees.—By G. H. BAILEY.—An apparatus for use in work requiring accurate maintenance of temperatures.—Its use in the determination of atomic weights.—2 illustrations..... 9248

Influence of Change.—The vapor pressures of matter in the solid and liquid states contrasted; notes on the nature of liquids, and other subjects.—3 illustrations..... 9249

Soap Bubbles.—A lecture by Prof. A. W. RUCKER before the British Association, September, 1886.—A most interesting treatment of the subject; determination of the constants of films; character of different films.—8 illustrations..... 9250

The Color of Metals.—By Prof. W. CHANDLER ROBERTS-AUSTEN.—A full report of this celebrated lecture, with accounts of the elaborate experiments performed by the lecturer.—2 illustrations.. 9247

VII. TECHNOLOGY.—Improved Gas Fire.—Mr. WILLIAM FOULIS' new open gas fire for use in living apartments, a substitute for the grate coal fire.—2 illustrations..... 9242

THE BELL TELEPHONE SUITS.

On the 24th day of January the hearing of the appeals in the five telephone suits before the Supreme Court of the United States began. From the bench of judges, Justice Woods and Justice Gray were absent. The former was ill, and the latter decided not to sit in judgment on the case, because his relatives held Bell telephone stock. The five cases are appeals by the following parties from decisions of the circuit courts: 1, Amos G. Dolbear; 2, the Molecular Telephone Co.; 3, the Clay Commercial Telephone Co.; 4, the People's Telephone Co.; 5, the Overland Telephone Co. The Court assigned a period of two weeks to the hearing, which is now going on from day to day.

Much sensation was created at the outset by Mr. Lysander Hill's charges in his brief and argument, relative to alleged collusion between Bell's attorneys and the Patent Office examiner. He charged that the original copy of the patent with erasures marked upon it had been withdrawn from the Patent Office, and a clean copy substituted. This charge was met by Mr. Storrow of counsel for the Bell Co., who stated that the change of specifications as alleged had never been made; but that he himself had made some comparative memoranda upon a certified copy of the specification for use in the Dowd case, and that these personal memoranda had been printed in the record in the Dowd case, and this was assumed by Mr. Hill to be a true copy of the original Bell specification, while it really had nothing to do with it. This was generally regarded as a point scored by the Bell Company. Mr. Lysander Hill appears for the Drawbaugh Company, the People's Telephone Co.

The immense size of the records before the court, and the magnitude of the interests involved in the decision, will render this one of the memorable law trials. The Bell Company is said to have already spent a million of dollars in litigation, and the value of their franchise, as indicated by dividends and outside interests, is probably worth over one hundred millions of dollars. The court has before it twenty volumes of records, embracing 15,000 pages, besides the voluminous briefs of the different counsel.

The fact that five cases are to be jointly tried, and that such full records of testimony are produced, would seem to point to a thorough sifting of the rights of the parties and of the true scope of the claims of the Bell patent. But unfortunately this thoroughness is only apparent. All the cases are burdened by concessions and weakened by omissions. The full case against Bell, it is to be feared, will not be presented.

The Supreme Court is rigorously confined in its judgments to the case as presented by the proofs taken in the lower court. It has no right to take or call for any new proofs. Its work is really a revision of the circuit courts' judgments. In recent times there has been a pronounced tendency on the part of the Supreme Court to decide against monopolies. Its memorable reissue decisions have done much to limit the scope of patents. Formerly, it was a frequent practice to reissue a patent before beginning a suit, thereby putting its claims and specification in condition for the specific suit to be brought. The Supreme Court has, by the decisions alluded to, put a stop to this practice. Each patent that comes before it must stand on its original claims. This alone has made many patents valueless. The court has also been much more vigorous in its treatment of patents than were the old school of judges. Its reputation now is that of a destroyer rather than of a sustainer of patents. Many a patent runs the gauntlet of the circuit courts successfully, to be pronounced invalid on appeal. Within late years, it has been impossible to withstand, with the least prospect of success, the Bell Company in the circuit courts, owing to previous favorable decisions. Whatever the issue, the merits are now to be judged by a tribunal whose tendency is opposed to patents, and which is unfettered by previous decisions.

A very interesting point is the bearing of the House telephone on these suits. No such complete defense against the Bell claims has yet been produced. First in the columns of this, and later in those of other papers, it has been described and illustrated. Yet the Supreme Court can make no use of it in framing an opinion, because it is not in the circuit court records. If the judges know of it, and they probably do, their position is a peculiar one. They may be convinced that it should break the Bell patent, or at least greatly abridge the claims, yet they can take no cognizance of it in rendering their decision. It is quite within their power to allude to it in their opinion, merely as a matter of history; but for them it is not evidence.

This is greatly to be deplored. The best and most conclusive defense yet produced is excluded from consideration. The court may find itself in the position of a judge who, following the verdict of a jury which has pronounced a man guilty, condemns him to punishment, knowing him to be innocent. This hypothetical case is one often cited by moralists.

On Feb. 4 the time set for the hearing expires. The opinion and decision will then be anxiously awaited. It is earnestly to be hoped that some limitation may be placed upon the extravagant claims of the Bell Co. Meanwhile, the Government suit for the cancellation of the Bell patent is progressing in Massachusetts. In this the House telephone will probably figure as a most important reference. But the remedy, if this shall prove the only one, comes at a late day. Already two-thirds of the period of the patent has nearly expired, and in 1893 the first Bell patent will be public property.

SIR JOSEPH WHITWORTH.*

On Saturday, January 22, Sir Joseph Whitworth died in his eighty-fourth year, at Monte Carlo. He was born at Stockport, Cheshire, England, on December 21, 1803. His education was limited; his father first taught him, and afterward he entered a private school at Idle near Leeds. At the age of fourteen he entered his uncle's cotton mill, and spent four years in the shop after leaving the operative department, where a congenial occupation was found in the general machine work. At twenty-one he moved to London, entering the employ of Maudesley & Clements. The latter had been associated with Babbage in the production of his calculating machine. There it was that he formed the conception of making machine tools to use in making other machinery, and it is in this line of work that he won a great share of his distinction. In 1830 he began to attain success in the production of his celebrated proof planes. In 1833 he returned to Manchester, and placed over his shop the unpretentious sign "Joseph Whitworth, tool maker from London." In this shop he introduced his great edge-planing machine.

The gauge of screws next engaged his attention, and he collected screws from all parts of England, and constructed his standard gauge of screw threads. He had to build a perfect engine lathe for his work. Six months' consecutive work was devoted to the production of a lathe screw thirty feet long. In some sense, this has proved itself the standard lathe of the world. He also developed the slide rest in this shop. Measuring engines next engaged his thoughts; and he ultimately produced his world-famous apparatus that measured within the 1-1,000,000 of an inch. Turning his genius to everyday life, he constructed a street sweeper that is said to have converted Manchester from a dirty to one of the cleanest of cities. From 1834 to 1849, he took out fifteen patents.

In 1854, Lord Hardinge, Master-General of Ordnance, invited him to construct machinery for making guns. This led him to make his famous experiments on rifles and projectiles. After two years' work, he produced his rifle, proved in direct trial far superior to anything of the kind in England or France. In 1856, he began his work on large ordnance, producing the famous Whitworth cannon. This has met with great favor among most nations, except Great Britain, where Sir W. G. Armstrong always obtained the supremacy as regards adoption of his guns and ammunition. His guns were used by the Confederacy in the civil war of the United States, and won encomiums from the artillerists.

His last work was the production of his hydraulic steel. He hailed the advent of the Bessemer steel process with ardor, but found its defects in the blowholes in the metal. He devised a press by which he subjected the molten metal to a pressure of six tons to the square inch, thus doing away with blowholes and increasing its strength immensely. One of his presses was called the 8,000 ton press. The results were extraordinary. The shafts of many steamers were made of this metal, those of the City of Rome and the Inflexible among others. In 1877 he applied it to armor plate. In 1868 he founded thirty £100 scholarships, which, by his advice, counsel, and donations of exhibitions to competitors, he fostered personally throughout his active days. They were designed to train young men in technical work, which he recognized as one of the needs of England. His baronetcy, which expires with him, he received in 1869.

Analyzed the Ashes.

Two barns said to be filled with unthrashed wheat were recently burned in Germany. They were insured, but it was impossible to collect, because the claim was made that the contents of the barns were simply straw. When the affair got into the courts, chemical experts were called to analyze the ashes. Wheat contains a large quantity of phosphoric acid, almost ten times as much as does straw. Naturally, in the burning of these barns, wood ashes, cement, and other mineral substances were mixed with the ashes submitted to the chemists, but none of these admixtures contain phosphoric acid. The experts found that of two samples placed in their hands one contained 10·2 per cent and the other 19 per cent of the acid, thus proving conclusively that the farmers were in the right, and the insurance companies, as is generally the case according to public sentiment, in the wrong.—*Fireman's Herald.*

*For a full account of the life and work of Sir Joseph Whitworth, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 248.

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THE PET AMBITION OF JOHN ROACH.

The papers are now teeming with appreciative notices of Mr. John Roach, the distinguished shipbuilder and still more remarkable statesman and philanthropist, who has recently gone to his rest. Mr. Roach was universally recognized as the most active, earnest, and productive of shipbuilders, and was widely known as a man of broad and sound views of political economy as judged from the point of view of the protectionist; but it is doubtful whether many, aside from his personal friends and his own employes, ever associated his name with those of the last named class of benefactors of their race. But the occasional hints at this modestly concealed side of the character of that great man which have appeared since his death have reminded me of one or two occasions in which he, while generally discussing matters of business, displayed characteristics hardly to have been anticipated in a man of his habits and occupations, and having a history and surrounding such as were his during all the earlier portion of his life.

I first met Mr. Roach nearly twenty-five years ago, during the most exciting period of the civil war, at that great Washington hostelry which was then, as it has remained, one of the most attractive fields of study for the reader of human nature that can be found among all the great public houses of this country. We had had occasion to discuss some matters relating to the operations of the navy—I was then in the service—and the conversation finally turned upon the general policy of the country, especially as affecting the administration of the navy department and the development of an efficient corps of engineers; and he insisted that I should accompany him, with a mutual friend, to his room, above stairs, where a pleasanter atmosphere and a bright fire might prove conducive to our comfort. In the course of our chat, the great shipbuilder exhibited such a capacity of mental grasp, such power of expression, and such clearness of vision in a field to which I had supposed him an utter stranger, that I was as much amazed as delighted. He took the leading part in the conversation, and kept us entranced with his wonderful magnetism, and, at times, his eloquence, until nearly daybreak, when we left him, completely tired out, while he was himself as fresh, apparently, as in the first hour of our interview.

At another time, meeting on the "limited" train, both *en route* to Washington from New York, he seized upon the first available opportunity to get me cornered at the smokers' end of the car, to tell me of a plan which, as he said, he had had in mind since the very earliest days of his prosperity, when he began to see a possibility of his being able, at some time in the future, to do something for other men who might have as little of this world's goods as he possessed but a few years before. His idea was that, at some time in the not distant future, when he should have placed his business on an absolutely secure footing, and should have made his family suitable provision against future needs, he would found an institution in the neighborhood of some large city, presumably New York, in which every impecunious inventor should find all the aid that he might need to perfect the devices which might be taking shape in his brain, and to get them into successful operation. He would establish a school of some kind, perhaps a technical school like that so splendidly started at Hoboken by the will of the late Edwin A. Stevens, with the operations of which he was thoroughly familiar, and in which he always exhibited a real interest, or like the Sibley College of Cornell University, and similar schools of mechanics and engineering, now becoming, fortunately, so common in the United States and Europe, but with the special modifications required to make his pet scheme an integral and essential part of the plan. He would make it possible for the needy inventor to find there all the tools, apparatus for experimentation, facilities for construction and operation of his invention, whatever, in fact, he might in any way find useful in its development, and even the aid of experienced mechanics and of learned men of science, all placed freely at his disposal; so that he might, quietly and comfortably, go about his work with an assurance that, if there was anything at all in his notion, it should be most certainly, and promptly, and effectively given working form and useful application.

Mr. Roach believed, as he said, that such an institution might, if properly organized and well managed, be made to return to the country many times its cost by securing the immediate development of valuable inventions and their prompt application where, without such aid, they might lie dormant and useless for years, or even be lost to the world altogether. As he put it, the successful development of a single such invention might give to the world the equivalent of millions of dollars in facilitating production, saving lives and property, or in promoting the comfort of the people.

The would-be philanthropist declared himself thoroughly in earnest in the matter, and was very anxious to learn all that could be ascertained in regard to the probable cost of such an institution, and was ready to contemplate with equanimity the expenditure of a million of dollars in this most philanthropic of schemes. He became finally very much inclined to add such an endowment as he contemplated to that of some already established technical school; but it is to be presumed that he never quite reached the point at which he aimed to bring his private fortune, preliminarily to its appropriation. Like many another good man, with a heart as large as his brain, he went under before he felt that he had gotten his own life-raft quite safe.

I have had several such experiences; but I have never met a man who seemed to me to take at once so large and so generous a view of the opportunities of wealth—with perhaps a single exception—as did John Roach. The incident was a very pleasant surprise to me, who had never suspected that so much thought for the less fortunate of his fellow mortals had found a place in the mind of a man who was driving so tremendous a business with such wonderful energy and persistence. The anecdote will probably be as pleasant a revelation to many others among his many friends, even, perhaps, to some who had known him much longer than its narrator. I doubt if even his nearest and dearest friends ever knew all the good that this fluent, yet reticent, man aspired to accomplish. The stories told by his own men of his thought of them, of his unceasing care for them, of his friendly aid and wise counsel, always freely given when asked, would make a volume, and a very touching and tender interest would it have to every "manly man," such as was John Roach himself.

R. H. THURSTON.

Sibley College, Cornell University,
Ithaca, N. Y., Jan., 1887.

Papier Mache.

The manufacture of papier mache (literally, "chewed paper") forms an important branch of the paper industry. Who does not remember those projectiles of our school days which we called "spit-balls," and which when thrown at a wall or ceiling adhered thereto with tenacity? What was most striking about these balls was their extraordinary hardness after they became thoroughly dry, this being the more marked in proportion as the chewing had been more perfect.

It was through observing such hardness that the idea occurred to some one to employ paper pulp in the manufacture of various objects. Yet the substance employed in the industry is not a "mashed" paper in the absolute sense of the word, but is a paper converted into a soft cardboard by mechanical processes.

In the manufacture of papier mache, the raw material used is a bluish-gray, unsized, strong, fine-grained paper. The sheets may be compared (whiteness, which is of no account, being excepted) to Annonay lithographic paper. Cotton forms the basis of it.

These sheets are pasted together by means of a layer of dextrine or starch, applied with a steel spatula. When the desired thickness has been obtained, the mass is put into a hydraulic press that operates in a highly heated drying room. Under the immense pressure of this apparatus there forms a solid block, which is as hard as boxwood or ebony, and which is perfectly plane or has the form of the mould in which the raw material, so ductile when moist and so hard when dry, was compressed. It can be moulded into any shape whatever, that of table legs, chair arms, rose-work, mouldings, etc.

This sort of wood, without pores, sap, fibers, and knots, is capable of being worked with the saw, the gouge, the rasp, and the lathe. It can be polished, if need be, although this operation is reserved for the thick black varnish that is applied to it in several coats with an intervening stay of a night in a very hot, air-heated drying room. When it comes from the latter the varnish is very hard, and is free from blisters and cracks. It is possible that many of the objects that are offered to us as being finished with Japan or Chinese lacquer are merely impregnated and covered with a mixture of gum copal, bitumen, tar, resin, and other hydrocarbons impregnated with lampblack and color in certain proportions.

The baking is the important point. When this operation has been too greatly prolonged, the varnish scales off and cracks; and when it has not been carried to a sufficient extent, the surface remains sticky. It is not necessary, then, to exceed a certain temperature, always higher than 100°.

This moulded and pressed paper can be easily turned in the lathe, and made into light and indestructible balls and beads, or be fashioned into inkstands, caskets, and cylinders.

It is from this substance that are manufactured all those bracelets of large black beads studded with Scotch imitation diamonds, all those necklaces, pins, clasps, and trinkets of all sorts that are taken for pitch coal or some precious wood. Again, those handsome bracelets composed of semi-lucid and opaline globules that seem to have been cut out of a stone formed of concentric layers, like certain precious stones, are merely of papier mache, cemented with white varnish and coated with the same. So, too, those beautiful nacreous, painted and gilded trays, round tables, and caskets that are known as Japanese work are merely papier mache. The Japanese know but one kind of gilding, while we have two—the dead and the brilliant. We have, likewise, a liquid nacre taken from the scales of the whitebait that well imitates the white currant and certain transparent berries. The nacre is solidly inlaid by means of the hydraulic press, and finally the surface is finished with pumice stone in order to make it perfectly even, and covered with a colorless varnish of the first quality.—*Bull. des Fabricants de Papier.*

The Wooden Railways of the United States.

The *Northwestern Lumberman* gives the following table of the various logging railways of this country:

	Number of roads.	Number of miles.	Number of miles standard gauge.	Number of miles narrow gauge.	Number of locomotives.	Number of cars.
Alabama	28	146	36	64	27	250
Arkansas	28	104	83½	61½	23	215
California	23	114	72	80½	40	549
Florida	15	176	85	35	18	203
Georgia	32	225	132½	2	61	244
Kentucky	4	44	50	4¼	7	177
Louisiana	9	35	2	19	9	67
Maryland	1	13	.....	13	2	12
Michigan	54	283	128	225½	60	1,370
Minnesota	1	3	5	.....	1	9
Mississippi	15	65	21½	31	15	139
Missouri	7	31	21	12	7	93
Nevada	2	8	.....	8	2	9
New Hampshire	3	19	26	.....	7	124
New York	4	9	6	.....	2	20
North Carolina	8	117	6	4	9	123
Ohio	5	18	5	12	3	36
Oregon	3	7	4	4	1	28
Pennsylvania	44	168	123	51	36	444
South Carolina	16	170	99	25	20	124
Tennessee	7	51	.....	51	4	80
Texas	35	153	.....	153	36	296
Utah	1	2	.....	.....	.....	4
Vermont	1	4	4	.....	1	15
Virginia	7	126	.....	107½	13	284
Washington Terr.	18	109	56½	27	12	114
West Virginia	5	32	7	8½	3	48
Wisconsin	7	56	38	2	9	95
Totals	383	2,288	1,011	1,001	428	5,182

These roads for the most part are made of wood, consisting of longitudinal poles or timbers, and the cars and locomotives that run on them are provided with grooved or double-flanged wheels. They are the cheapest form of railway. The estimated aggregate amount invested in these roads is close on to twelve millions of dollars, itemized as follows:

428 locomotives at $4,000	$1,712,000
5,182 cars, at $150	777,300
2,288 miles roadbed and track, at $4,000	9,152,000
Total	$11,641,300

How to Cleanse Drop Oil.

An interrogator in one of our Continental exchanges wishes to know how he can cleanse the thick drop oil from the engine, bearings, shaftings, pulleys, etc., so that it can again be used for lubricating, and N. A. answers as follows:

This drop oil is collected in many mills and factories to be cleaned and used again. A little apparatus has been constructed for this purpose, which, it is reasonable to suppose, is patented. It may be described as follows: The apparatus is a box-like concern, of several "stories," the interior either lined with, or else consisting entirely of, lead. Above, it has a shoulder like a funnel, into which is poured the oil to be cleaned. The purified oil passes off through an escape pipe in the bottom. The different shelves, or "stories," are perforated and covered to a height of about two inches with raw, loose cotton, through which the oil must percolate. The cotton serves as filter, and retains all kinds of contaminations. After the oil has in this manner passed through the several shelves, it is nice and clean and drops into a vessel underneath. The dirty cotton is occasionally replaced by clean. This is about the most inexpensive way of effecting it that I know of. It is also necessary to add that the apparatus must stand in a warm place. The cleaning of the oil with chemicals is both a tedious and a doubtful process, because even after thorough washing it may still retain traces of acids, rendering it unfit for lubricating purposes.

Change of Officers.

The death of John Roach, who was president of the Chalmers-Spence Co., of New York, well-known manufacturers of asbestos goods of all kinds, left a vacancy, which was filled by the trustees of the company, on the 24th inst., by the advancement of Robert H. Martin, the former secretary and business manager. Mr. Geo. E. Weed still holds the position of treasurer, while Mr. C. H. Van Nostrand, the former efficient and agreeable managing clerk, has been made secretary of the company. The business of this company is steadily on the increase.

Comet *a*, 1887 (Thome).

Science Observer says: On January 24, a cable message, received from Dr. A. Krueger, announced the discovery of a bright comet by Dr. Thome, Director of the Observatory at Cordoba, on January 18, in the constellation Grus, and further stated that the object will become very brilliant, and in physical characteristics similar to the great comet of 1880. The tail of this comet was seen at Melbourne on the night of January 21, as reported by the Associated Press.

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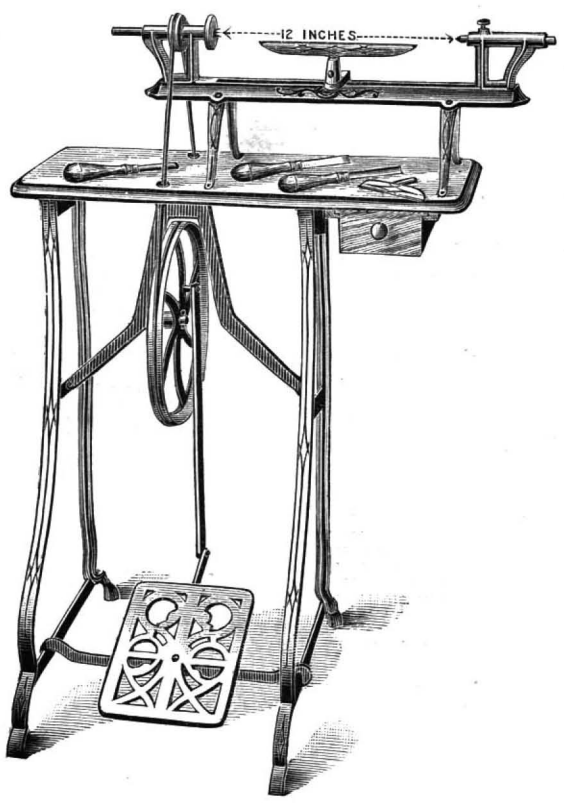
LATHE FOR AMATEURS AND LIGHT SHOP WORK.

The illustration herewith shows a practical form of lathe for a large variety of work. It is sold at a very low price, on account of the large demand that there is for such an article, from young beginners in mechanical work. The lathe has 4½ inches swing, is 12 inches between centers, and has a face plate for turning cups, a long and short tool rest, and three turning tools. A scroll saw is also furnished for use in connection with the lathe. The saw is attached to the table, so that it can be removed easily, and the lathe as



THE HOUSE LATHE.

easily attached. The saw swings nearly 16 inches in the clear, and, though not calculated for heavy work, saws inch walnut readily. The lathe rests on iron legs screwed to the table, the saw being operated independently of the lathe, thus avoiding the unsteadiness and noise which so often render one or the other of these appliances nearly useless.

This machine is made by A. H. Pomeroy, of Hartford, Conn., who furnishes an illustrated catalogue.

AN ELECTRICAL MUSIC BATON.

Those who frequent the opera must certainly have been struck with the regularity with which the choruses or orchestras of the side scenes follow the measure beaten by the leader of the orchestra. It is very rare that the arm of the one is in advance of or behind the voices or instruments of the others. How is such a result brought about? Up to the present, the means have been of the most elementary character. The leaders of the choruses in the side scenes have followed by eye the motions of the orchestra leader's arms. This was not always an easy thing to do, especially when the stage was entirely closed by scenery; and the musician who beat the measure in the side scenes was obliged to obtain a glimpse of the hall through an aperture or fissure, and get over the difficulty the best way he could.

This process has recently been discarded, and there is now being used for leading the music of the side scenes a metronome, which we herewith illustrate, and which is the invention of Mr. Carpentier. The operation of this is of the simplest character. At the representation of "Patrie," for example, in the fourth act the confederate Flemings perceive that they have been denounced, on hearing the music that precedes the Spanish troops, and the strains of which gradually mingle with those of the orchestra. In the side scenes, the measure is here marked by means of the Carpentier metronome placed upon the music stand of the side scenes leader, and connected with the orchestra leader's stand by two electric wires.

The apparatus is represented in Fig. 2. It consists of a blackboard, which, if it be desired, can be hung upon the scenery, and the principle of which is based upon a curious optical illusion. On the surface of the board the reader sees a white and a black line, the latter hardly visible. Each of these lines marks the position of a ruler mounted in a groove in the board in such a way that it can pivot a quarter of a revolution on its axis, and alternately show two surfaces, one of which is white and the other black like the board. In the figure, the upper ruler exhibits its white surface, and the lower its black one. As by a rapid and simultaneous pivoting the upper ruler becomes black and the lower one white, the spectator seems to see but a single ruler, which appears to move backward and forward. The illusion is perfect, even though the artifice be known.

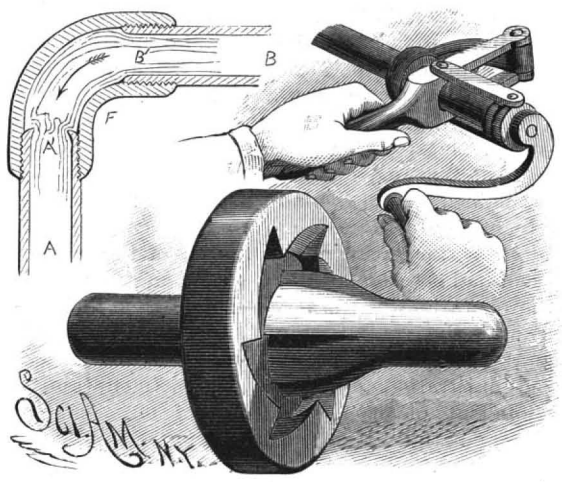
Such is the principle of the apparatus. As for its mechanism, that is very simple, and the details of it are shown in Fig. 3. Here may be clearly seen the two rulers, G, H, at the neighboring extremities of which may be distinguished two small rollers, over which run cords. Each of these cords is pulled at one end by a spring and at the other by the armature of an electro-magnet, F. As long as no current is traversing the electro, the springs hold the rulers in one of their two positions; but when the electro acts, the springs yield, and the rulers abruptly pivot.

As for the maneuvering of the apparatus, that devolves upon the leader of the orchestra. Fig. 1 shows the post of the leader, who stands upon a low platform among his musicians. Under his right foot he has an iron pedal, A, mounted upon two rods that extend beneath the platform, and at the least pressure set up an electric contact. The reader will see that if the leader presses the pedal, a current will pass, and the phantom baton will be observed in its lower position, and that if the pressure be removed the baton will rise, thus perfectly obeying the foot of him who controls it. While maneuvering the apparatus, the leader has his two hands free, the right one to hold his baton, and the left to turn the pages of his music. We must state, in addition, that he has under his eyes, and lying flat on his stand, an apparatus, D, which is a reproduction, on a small scale, of the one between the scenes. The two apparatus are connected by the wires, B, C, E, and make identical movements, the smaller one informing the leader of the effect of the motions of his foot, and guarding him against irregularities that might be followed by disagreeable consequences. The same small apparatus is shown at the bottom of Fig. 3.

This new electric baton operates with great precision, owing to the fact that the masses in motion are very small. It presents, moreover, the advantages of visibility that would be possessed by a baton held in the hand, since it has every appearance of such.—*L'Illustration.*

DEVICE FOR TRIMMING THE ENDS OF TUBES.

Tubes cut in two in the usual way have upon the outside a slightly roughed or burred edge and upon the inside a rough and ragged edge, that serves to most materially lessen the bore of the tube at each joint, as



DELGADO'S DEVICE FOR TRIMMING THE ENDS OF TUBES.

shown at A', and at the same time to form a well adapted lodging place for any sediment carried by the fluid passing through the pipe. The obstruction thus presented is gradually and surely increased by the lodging sediment, and the flow through the pipe thereby lessened, until finally the pipe is completely choked. To easily and quickly remove these rough edges, so that the end of the pipe will present an evenly rounded surface, as shown at B', that will offer no obstruction to the flow and form no recess for the sediment to lodge in, is the object of the simple and ingenious device here illustrated.

Pivoted in the forked end of the handle is a curved arm, having an aperture formed in its enlarged outer end, through which the pipe to be trimmed is passed. Upon the inner side of the end of the arm, and flush with the edge of the aperture, is a projection, the serrated edge of which rests against the tube to hold it firmly. To each shank of the fork is pivoted a link, between the outer ends of which is swiveled an apertured disk, through which the shaft of the cutting tool passes, the outer end of the shaft receiving a crank handle, by means of which the cutter may be turned to trim the end of the tube. The cutting tool, shown enlarged in the lower view, consists of a disk through which passes a shaft. One face of the disk is formed with cutting teeth, while the hub of the shaft upon the same side is slightly enlarged and also formed with

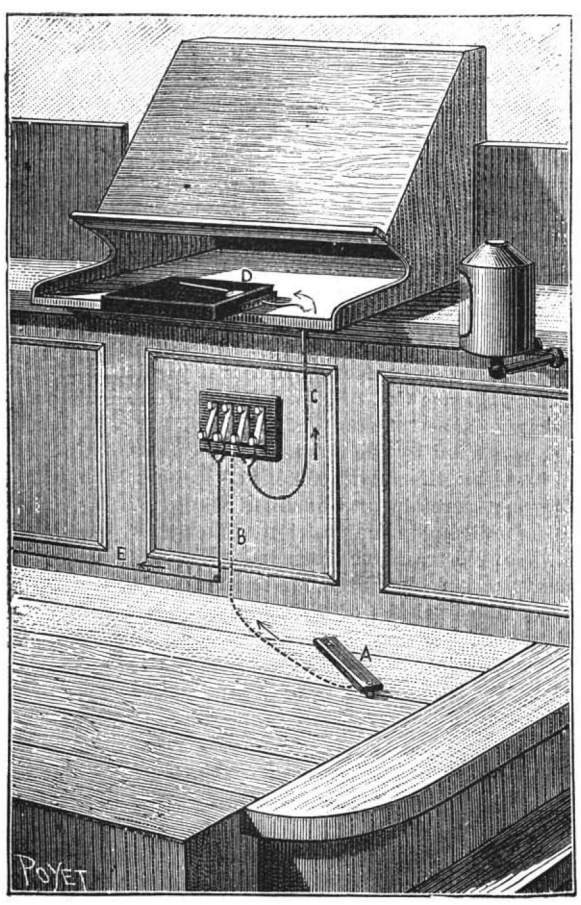


Fig. 1.—LEADER'S STAND.

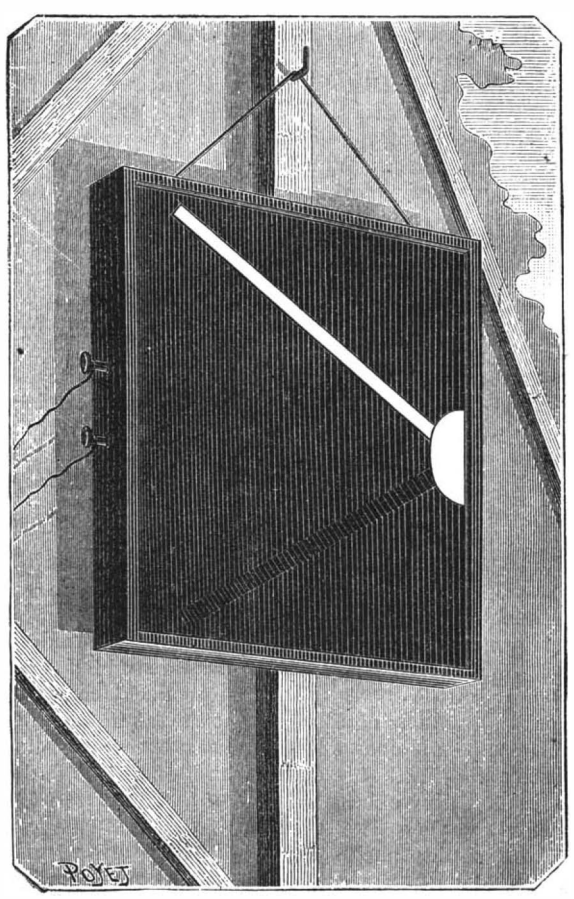


Fig. 2.—ELECTRIC MUSIC BATON.

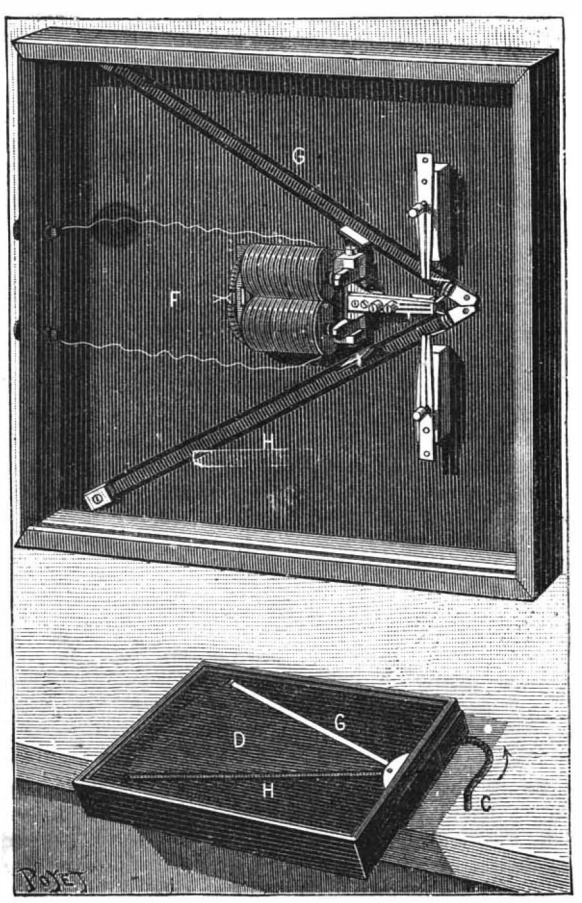


Fig. 3.—MECHANISM OF THE BATON.

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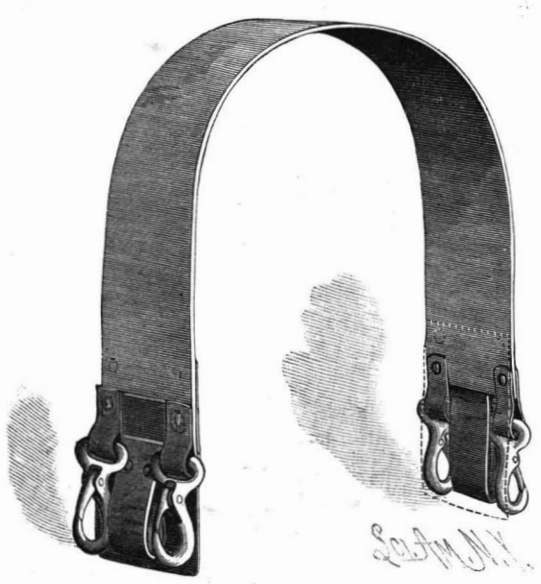
teeth. It is evident that this cutting tool, which may be turned either by hand or by means of the device above described, is well adapted to the work, and will effectually remove the rough edge from both the inside and outside of the tube.

This invention has been patented by Mr. E. Querol y Delgado, whose address is 142 Hull Street, Brooklyn, N. Y.

BACK BAND FOR HARNESS.

This back band is designed for use in harness in which chains form the traces. To each end of the back band, which is a broad piece of leather of sufficient



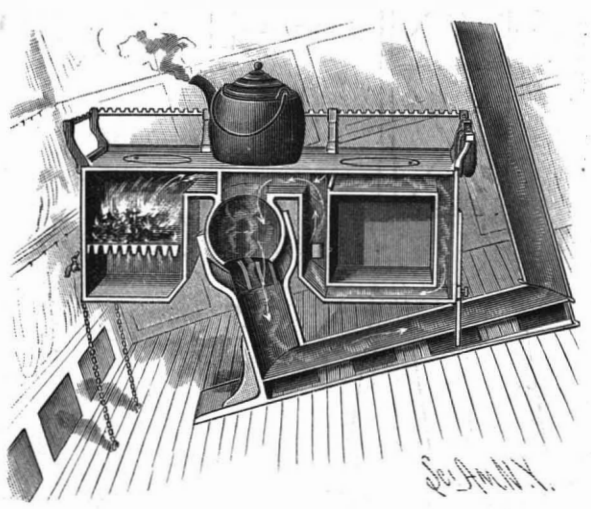
JOHNSON'S BACK BAND FOR HARNESS.

length to pass over the back of the horse, is riveted a metal plate formed with a T-head at one end, through which the rivets pass. The lower portion of the plate is folded upon itself to form the loop for the trace. To prevent the plates chafing the horse, they are covered with leather strips, which are, preferably, tongues formed at the ends of the back band. Snap hooks are attached to the ends of the band and to the plates by means of metal loops held to the band and plates by the same rivets that connect the plates to the band. The loops are covered with leather strips. By making the back band in this way, the loops in the plates take the wear of the traces and preserve the leather of the band, while the metal loops holding the snap hooks take the wear of the hooks, so that the durability of the band is greatly increased; and by the use of the snap hooks the band is made much more convenient than the ordinary band of this character.

This invention has been patented by Mr. Ike Johnson, of Honey Grove, Texas.

BALANCED COOKING STOVE FOR SHIPS.

This stove is designed for use on ship board, as it is accurately equipoised on its base, so that it will always maintain a horizontal position, no matter to what extent the ship may roll. The frame of the stove is constructed to form a fire box and ash pit at one end and a separate oven at the opposite end. The oven and fire box are separated by a central space or chamber inclosing the upper end of the base or support. The top plate, to which the fire box and oven are joined, is provided with a hollow ball, open at the top and bottom, and fitting in a hemispherical



BEKOFSKY'S BALANCED COOKING STOVE FOR SHIPS.

seat or cup of the base, thus pivotally supporting the stove. The base forms the chimney of the stove, and is connected at its bottom with a horizontal pipe which extends as far as convenient, and connects with a vertical pipe. Beneath the horizontal pipe is formed an air space that prevents burning the deck. The flame and products of combustion may, by properly arranging a damper, be made to pass directly to the chimney or to pass first around the oven. Between the fire box and oven are formed boxes, which may be closed by doors and which serve as warming ovens to be used for heating plates, etc. From the top of the stove rise arms supporting rods notched in the upper edges, and on these are placed two movable weights formed with open hooks, so that they can be easily shifted, in order to be brought opposite any pan or kettle for properly counterbalancing and keeping the stove in an upright position. When the stove stands at an angle, the lower opening in the ball will be partially closed by the sides of the cup, which tends to interfere with the draught. To avoid this, the cup portion is formed with numerous side openings, sufficient in size and number, so the aggregate area of the openings will never be less than the sectional area of the support. At one end of the fire box may be formed a water-heating reservoir. On smooth water the stove may be chained to the deck by four chains, or four legs sliding in vertical grooves may be used instead.

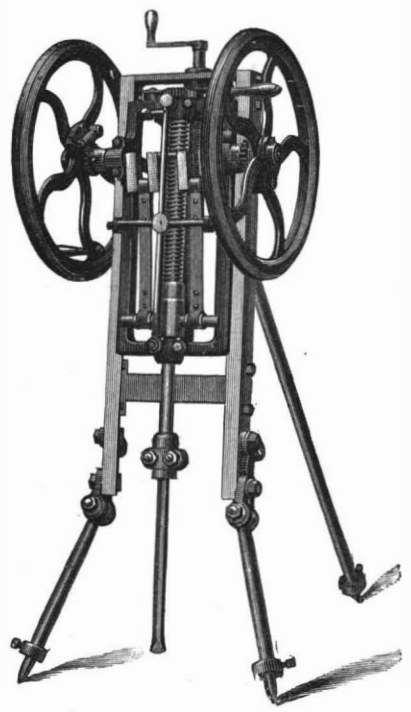
This invention has been patented by Mr. V. S. Bekofsky, Isaakiefsky. pl. n. $\frac{6}{89}$, care Restaurant, Mrs. Michel, St. Petersburg, Russia.

THE INGERSOLL DUPLEX ROCK DRILLING MACHINE.

The engraving illustrates an invention which was patented in July, 1886, in the United States, Canada, England, France, and Germany. It is the result of many years' practical experience, and has several novel features.

The drill shaft is journaled to revolve, and to reciprocate vertically in bearings in a carriage, which is fitted to slide on the side bars of the frame. The hand crank wheels are mounted to revolve freely on the main shaft, with which they are connected by pawls and ratchets.

The main shaft is journaled horizontally in the drill carriage, and is provided with two cranks, which are connected by straps with the cross head of the drill shaft. The cross head is fitted to slide vertically on the drill carriage, and the drill shaft is journaled to rotate in the cross head, but it is provided with rigid



THE INGERSOLL DUPLEX ROCK DRILLING MACHINE.

collars above and below the head, whereby the head lifts the drill shaft. Around the drill shaft a powerful spring is coiled, to drive the drill into the rock. A feed screw, provided with a hand crank at the top of the machine, is journaled in the upper cross bar of the frame. On the feed screw is a nut journaled in the upper cross bar of the carriage, and provided with ratchet teeth. On the front of the carriage is a feed lever, whose upper end is provided with a pawl to engage the feed screw nut, and whose lower end has a screw point to be engaged by a wedging collar on the drill shaft at each throw thereof. The drill shaft is spirally grooved and provided with a splined ratchet wheel and a pawl, whereby the drill is rotated a little at each stroke, so as to take a new chip. The frame is mounted on a tripod, each leg of which has telescopic adjustment, and the hinge joints are so arranged that the drill may be set to work horizontally, or at any downward slant, and at almost any upward slant.

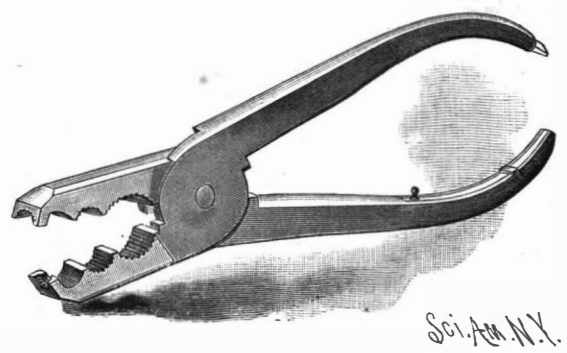
In operation, the feed screw is first to be turned until the drill point rests firmly on the rock to be drilled, then turn the crank wheels until the hole is drilled deep enough. The pawls on the wheels engage the ratchets on the main shaft and turn it forward, lifting the drill against the resistance of the spring. When the shaft cranks pass over center, the spring drives the drill into the rock with all its force, the ratchets of the shaft revolving freely forward ahead of the pawls on the wheels, and the shaft cranks throwing past their lower dead center. Then the pawls again engage the ratchets as before; so that two full revolutions of the shaft and two strokes of the drill are produced by each revolution of the drive wheels, thus permitting the operator to work moderately, and at a living speed, while the drill makes double the same speed without any jar on the machine. This is a new mechanical device, and it gives the name "Duplex" to the machine. While the feeding device may be adjusted to feed at different rates of speed, yet it is purely automatic when at work, and adjusts itself to the varying hardness of the rock in the progress of drilling each hole, so that, if a soft stratum be entered, the carriage will be fed fast enough to make each stroke do work; or if a hard streak be struck, the drill will not be forced ahead any faster than it has cut away. Practical miners will appreciate the value of this characteristic in the saving of drill points and in the saving of wear and tear on the machine.

Already the demand for these machines is very large, and it has become necessary for the manufacturers to provide them with engines attached to meet all requirements.

For further particulars, address the agent of the manufacturers and owners of the patents, Mr. W. X. Stevens, 705 G Street, N. W., Washington, D. C. Also see our Business and Personal column.

IMPROVED GAS PLIERS.

The engraving represents a combination tool embodying pliers having variously sized jaws, a wire



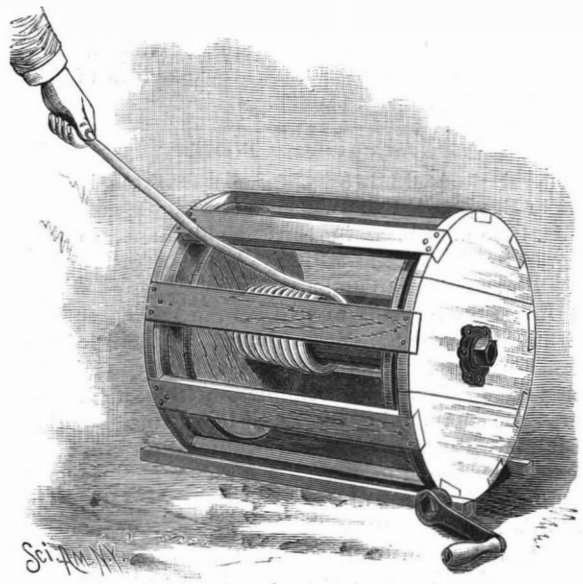
DAHL'S IMPROVED GAS PLIERS.

cutter, a lava tip turning attachment, a band for cleaning the slots of lava tips, a screw driver, and a stopcock or valve turning recess. Each jaw is formed with two concave serrated recesses arranged to register as shown. In the extreme end of each jaw is a serrated recess, back of which is a semicircular flange, still back of which is a plain-faced recess. When the faces of the end recesses are brought into engagement with the tops of the burners, the lava tips will pass through the apertures of the flanges and enter the plain recesses. The lava tips may be brought into the bite of the flanges, and so forced within their sockets. In each section of the pliers, just back of the recesses, is formed a slot having a cutting edge. These constitute a wire-cutting attachment. The inner edges of those portions of the handles next the pivot are parallel when the jaws are brought together, thus providing for the reception of the thumb piece of a valve and enabling the operator to turn any valve or stopcock that may have become bound. The rear end of one handle is formed as a screw driver, while in a recess in the other handle is fitted to slide a spring strip, that may be used to clean out the slits of lava tips.

This invention has been patented by Mr. Will P. Dahl, of 919 25th Avenue South, Minneapolis, Minn.

IMPROVED LEAD PIPE REEL.

Lead pipe is usually put up on reels which do not have an inclosing case, the heads of the reels being con-



EITAPENC'S IMPROVED LEAD PIPE REEL.

nected by slats, which must be knocked off before the pipe can be unreeled and disposed to customers; and before the reel can be turned, it is necessary to elevate it upon a bar passed through its hollow shaft or body. Like trouble also attends the putting up of the pipe on the reel. These difficulties are obviated in the invention here illustrated, which has been patented by Mr. Fred. Eitapenc, of Oneonta, N. Y. The outer reel case

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is of circular form, and is made up of opposite heads connected by slats. Within the case is arranged the reel proper, which is provided with two heads, suitably connected together and mounted upon a shaft having bearings in the heads of the case.

One end of the shaft projects sufficiently far to receive a crank handle, by means of which the reel may be turned. By this construction there will be no necessity of raising the reel from the ground either to coil the pipe upon it or to remove it, while the slats need not be removed, as the pipe can be passed between any two of them. The reel is thus rendered more durable by not having to knock off the slats to pay out the pipe, and the whole is so fitted that it may be readily taken apart when required.

Honor the Inventor.

We regret that there is a disposition sometimes to speak sneeringly of the various patent devices that are brought to the attention of the public, and it is possible that there are also sneers for the inventors of these devices. While it is true that there are some cranks among inventors, and while it is true that many of the patent devices are crude and impracticable, yet each one represents an original idea, which, combined with the original ideas represented in other devices, has made our people the foremost on the earth. There have probably been some worthless inventions patented at Washington, and it is probable that ninety-nine out of every hundred have yielded no returns to the owners; but it is a truth nevertheless that there are very few of the whole of the vast number which have not served a noble purpose, the ideas contained in each having been at some time and in some form utilized in producing the perfected device, that works with greater precision and the apparent intelligence of the human will. It is not one inventor to whose genius is due the perfect machine of to-day, but it may be that the ideas of a thousand have been combined to produce that result, many of whom are dead, nearly all of whom are forgotten and their names unknown, save as they are written upon the musty records of the patent office.

Unaided by the genius of the humble and sometimes cranky inventors, the world with its billions of capital and its millions of strong and willing arms would have made but poor progress in bringing railroading up to its present state of perfection. The tremendous possibilities of the future are bounded only by the genius and the labor of inventors. There will be no lack of labor and capital, but all will depend upon the men who wear their lives out in making the practical application of an idea to which their genius has given birth. A few more efforts, and the thousand or so of geniuses and cranks miscalled "the patent car coupler fiends," but who are really angels in disguise, will give us a car coupler that annually saves many thousands of valuable human lives. A little more labor, and the inventors will give us a brake that will greatly lessen the number of collisions. A few more improvements, and we shall have such tunneling and grading machinery that, instead of going over and around mountains and hills, we shall go straight through and under them, giving us solid tracks without grades and curves; and in a word, instead of our trains making fifty miles an hour, we shall with greater safety make one hundred miles an hour, at just such time as it shall suit the convenience of our inventors to have us do so.

Then by all means let us give every encouragement and aid possible to inventive genius. Instead of contracting, let us enlarge in every manner possible the scope and usefulness of the patent office. Instead of sneering at the "crank" inventors of patent devices, let us honor them as the greatest benefactors of their race.—*Railway Service Gazette.*

Gen. Charles P. Stone.

General Stone, known as Stone Pasha from his services in Egypt, died in this city, January 24, of pneumonia. He was born in Springfield, Mass., in 1826. He graduated from the Military Academy in 1845, and served in the Mexican and civil wars. He resigned from the United States army in 1864, and in 1870 accepted a position under the Khedive of Egypt. His work in reorganizing the Egyptian forces received the highest praise. He resigned his commission in 1883. He was offered the command of the English expedition against El Mahdi, but refused it, as he could not obtain a sufficient allowance of forces. His work as engineer and director of the pedestal for the Statue of Liberty on Bedlow's Island, in New York Harbor, won him considerable notoriety. This was the last work of his life, being completed but a few months before his death.

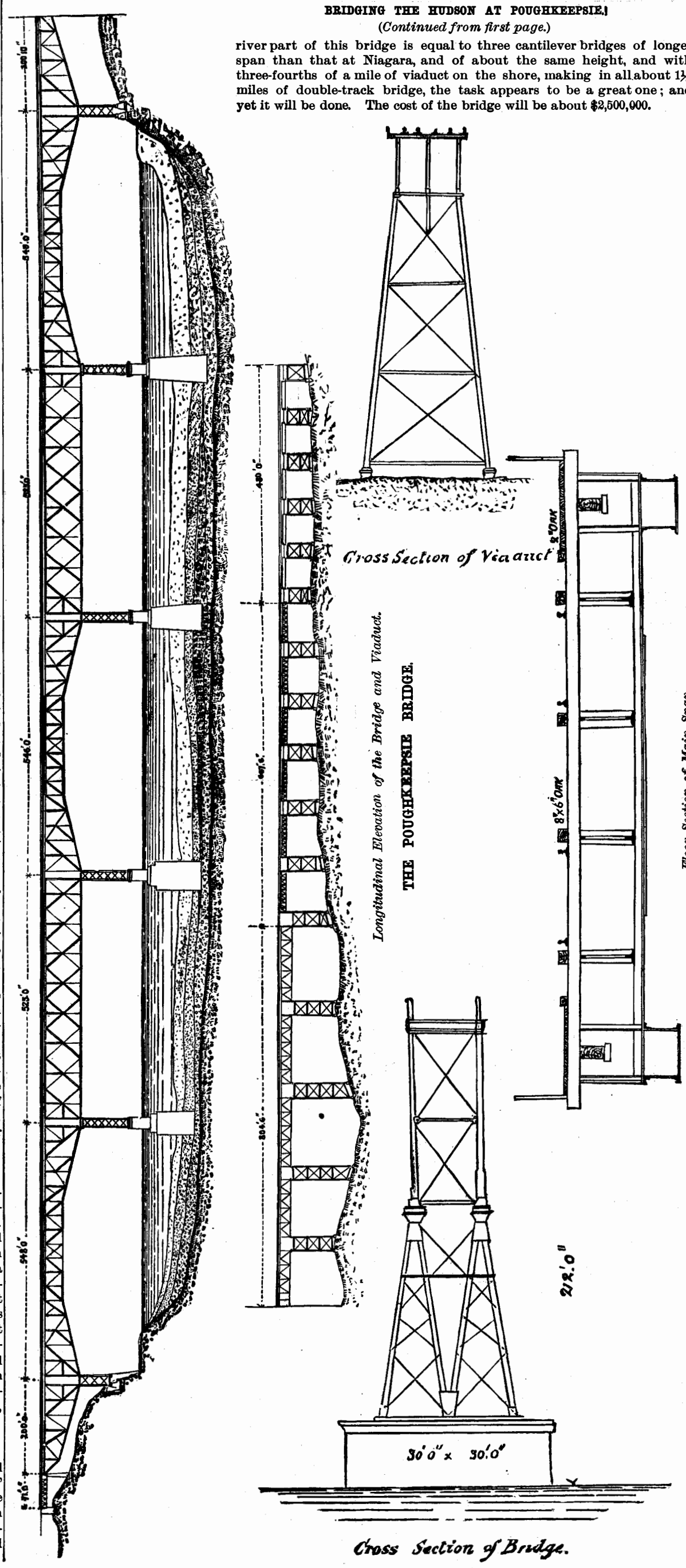
A Chance for the Inventors.

"The man who will invent a connection for bell ropes which will not break glass can make a fortune," said one of the attaches of the car department of the Pennsylvania road to an expressionist. "We lose an enormous amount of plate glass each year by breakage through the use of the iron connections on bell ropes."—*Buffalo Express.*

BRIDGING THE HUDSON AT POUGHKEEPSIE.

(*Continued from first page.*)

river part of this bridge is equal to three cantilever bridges of longer span than that at Niagara, and of about the same height, and with three-fourths of a mile of viaduct on the shore, making in all about 1⅓ miles of double-track bridge, the task appears to be a great one; and yet it will be done. The cost of the bridge will be about $2,500,000.



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Correspondence.

Explosive Effects of Dynamite.

To the Editor of the Scientific American:

I have seen of late in various publications many theories advanced in trying to account for the almost utter annihilation of human bodies by dynamite or nitro-glycerine explosions, most of which point to the direct action of the explosive. Owing to extraordinary rapidity of ignition and expansion, and consequent instantaneous formation of a vacuum, may not the terrible rending into fragments of bodies within the immediate vortex of the explosion be accounted for on the hypothesis of a sudden expansion of the air contained in the lungs and other parts of the body?

J. H. DURHAM.

Cape Vincent, N. Y., Jan. 21, 1887.

Discovery of a New Comet (Comet Brooks No. 1 of 1887).

To the Editor of the Scientific American:

On Saturday evening last, January 22, 1887, about 7 o'clock, I discovered a new comet in the constellation Draco.

Its approximate right ascension at that time was 18 hours; declination north, 71 degrees. The comet is rather small, faintish, and has a slow easterly motion. Telegraphic announcement was at once made, and news of the discovery was cabled to Europe the same evening.

This is the first comet of the new year, and ranks as the tenth comet it has been my good fortune to discover during the past few years. It was in this constellation—Draco—and a few degrees distant, that I discovered the second comet of 1883, now known as the Pons-Brooks comet. The new object being circumpolar does not set, but remains above the horizon the entire night. WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
January 22, 1887.

Another Poisonous Snake in Pennsylvania.

To the Editor of the Scientific American:

I am a frequent reader of the SCIENTIFIC AMERICAN. The very interesting article in it on rattlesnakes, by Henry Guy Carleton, in March, 1886, and the saying of an "Undergraduate," "They were being taught we have but two poisonous snakes in this section of the United States, and the blowing viper is not poisonous," prompt me to offer a description of a third poisonous one, killed by myself, here in Lycoming County, Pennsylvania, my home for over thirty years.

This snake was a dull black color from head to tail, above; beneath, three colors, mechanically mingled—white, cobalt blue, and gamboge yellow. Length, 4 feet; thick and clumsy; the skin loose and very thick; head, 2 inches broad, with a horn solidly attached to the nose, three-eighths of an inch broad and the same high, having an arched point, bent backward. There are two fangs in the upper jaw, three-quarters of an inch long; stouter than a rattlesnake's; of the same size.

On striking it with a stone, it came straight at me, the head raised about a foot, its throat flattened to 3 inches or more, and the jaws opened very wide, and blowing and hissing like a goose.

I have met with but one other, that hissed and moved away quickly. We have had rattlers killed every year; copperheads, less frequently. We have another blowing snake, not uncommon, with a head like an eel's, a thin tail, no fangs; these are of very light colors—pinkish chestnut and white, chiefly; mostly about 2½ feet long, with round bodies.

E. R.

Williamsport, Pa., Jan., 1887.

Algaborilla.

Husks known under the name of algaborilla contain a tannin-like substance, which can be used for dyeing yellow. The trees from which these husks are obtained are the Prosopis pallida and the Prosopis algarobo, which occur in the mountainous districts of South America. The seeds form about one-fifth of the weight of the husk, but contain no tannin. The husks contain about 27 to 29 per cent of the tannin. The coloring matter yields yellow precipitates, with salts of tin, antimony, lead, or alumina; the tin compound is the brightest. For dyeing yarn, the latter is mordanted with tin, as usual, and placed in the dye bath, which contains water heated to boiling and about 7 to 10 per cent of algaborilla. After working the yarn in the bath for some time, the bath is left to cool, and the yarn afterward washed and dried. The color is not as brilliant as that obtained with fustic, but more of a straw color; it is, however, pretty fast, and resists weak acids; alkalies change the color into brown. With iron mordants, good grayish black shades can be produced, and 5 to 7 per cent of the husks will be sufficient for the bath. Wool can also be dyed with algaborilla.

Birds' Nests and Eggs.*

The philosophy of birds' nests and eggs involves questions far too profound to be settled in an hour's lecture. The extreme partisans of one school regard birds as organic automata. They take a Calvinistic view of bird life; they assume that the hedge sparrow lays a blue egg because, under the stern law of protective selection, every hedge sparrow's egg that was not blue was tried in the high court of evolution, under the clause relative to the survival of the fittest, and condemned, a hungry magpie or crow being the executioner. The extreme partisans of the other school take an entirely opposite view. They regard the little hedge sparrow not only as a free agent, but as a highly intelligent one, who lays blue eggs because the inherited experience of many generations has convinced her that, everything considered, blue is the most suitable color for eggs.

Perhaps the first generalization that the egg collector is likely to make is the fact that birds that breed in holes lay white eggs. The sand martin and the kingfisher, which lay their eggs at the end of a long burrow in a bank, as well as the owl and the woodpecker, which breed in holes in trees, all lay white eggs. The fact of the eggs being white, and consequently very conspicuous, may have been the cause, the effect being that only those kingfishers which bred in holes survived in the struggle for existence against the marauding magpie. But the converse argument is equally intelligible. The fact that kingfishers breed in holes may have been the cause, and the whiteness of the eggs the effect; for why should nature, who is generally so economical, waste her coloring matter on an egg which, being incubated in the dark, can never be seen? The fact that many petrels and most puffins, which breed in holes, have traces of spots on their eggs, while their relations the auks and the gulls, who lay their eggs in open nests, nearly all lay highly colored eggs, suggests the theory that the former birds have comparatively recently adopted the habit of breeding in holes, and that, consequently, the color, being no longer of use, is gradually fading away. Hence, we assume that the color of the egg is probably the effect of the nature of the locality in which it is laid.

The second generalization which the egg collector is likely to make is the fact that so many of these birds which breed in holes are gorgeously colored, such as kingfishers, parrots, bee eaters, etc. The question naturally arises, Why is it so? The advocates of protective selection reply: Because their gay plumage made them so conspicuous as they sat upon their nests, that those that did not breed in holes became the victims of the devouring hawk, exactly as the conspicuous white eggs were eaten by the marauding magpie. But the advocates of sexual selection say that all birds are equally vain, and wear as fine clothes as nature will let them, and that the kingfisher is able to dress as gorgeously as he does because he is prudent enough to breed in a hole safe from the prying eyes of the devouring hawk. The fact that many birds, such as the sand martin and the dipper, which breed in holes, are not gorgeously colored, while others, such as the pheasants and the humming birds, are gorgeously colored, but do not breed in holes, is evidence, as far as it goes, that the gorgeous color of the bird is not the effect of its breeding in a hole, though the white color of the egg probably is. It must be admitted, however, that the latter cases are not parallel. While the hen kingfishers and bee eaters are as gorgeous as their mates, the hen pheasants and the hen humming birds are plainly, not to say shabbily, dressed. If birds be as vain as the advocates of sexual selection deem them, it must be a source of deep mortification to a hen humming bird to have to pass through life as a foil to her rainbow-hued mate. While the kingfisher relies for the safety of its eggs upon the concealed situation of its nest, the humming bird depends upon the unobtrusiveness of the plumage of the sitting hen.

A very large number of birds, such as the grouse, the merlin, most gulls and terns, and all sandpipers and plovers, rely for the safety of their eggs upon the similarity of their color to the ground on which they are placed. It may be an open question whether these birds select a site for their breeding ground to match the color of the eggs, or whether they have gradually changed the color of their eggs to match the ground on which they breed; but, in the absence of any evidence to the contrary, it is perhaps fair to assume, as in the previously mentioned cases, that the position of the nest is the cause, and the color of the egg the effect.

Many birds make their nests in lofty trees, or on ledges of precipitous cliffs. Of these, the eagles, vultures, and crows are conspicuous examples. They are, for the most part, too powerful to be afraid of the marauding magpie, and only fear the attacks of beasts of prey, among which they doubtless classify the human race. They rely for the safety of their eggs on the inaccessible positions of the nest. Many of them also belong to a still larger group of birds who rely for the safety of their eggs upon their own ability, either singly, in pairs, or in colonies, to defend them against all aggressors. Few colonies of birds are more interesting than those of herons, cormorants, and their respective allies. These birds lay white or nearly white eggs. Nature, with her customary thrift, has lavished no color upon them because, apparently, it would have been wasted effort to do so; but the eggs of the guillemot are a remarkable exception to this rule. Few eggs are more gorgeously colored, and no eggs exhibit such a variety of color. It is impossible to suppose that protective selection can have produced colors so conspicuous on the white ledges of the chalk cliffs; and sexual selection must have been equally powerless. It would be too ludicrous a suggestion to suppose that a cock guillemot fell in love with a plain colored hen because he remembered that last season she laid a gray colored egg. It cannot be accident that causes the guillemot's eggs to be so handsome and so varied. In the case of birds breeding in holes secure from the prying eyes of the marauding magpie, no color is wasted where it is not wanted.

The more deeply nature is studied, the more certain seems to be the conclusion that all her endless variety is the result of evolution. It seems also to be more and more certain that natural selection is not the cause of evolution, but only its guide. Variation is the cause of evolution, but the cause of variation is unknown. It seems to be a mistake to call variation spontaneous, fortuitous, or accidental, than which expressions no adjectives less accurate or more misleading could be found. The Athenian philosophers displayed a less unscientific attitude of mind toward the unknown when they built an altar in its honor.

*Abstract from *Nature* of a lecture delivered by Mr. H. Seebohm at the London Institution on December 20, 1886.

Krupp's Prussian and Carnegie's Pittsburg Steel Works.

A visitor to the famous Krupp steel works gives an interesting account of its operations, which is related in the *American Engineer*. He saw a ten ton crucible steel casting being poured, and an enormous seventy ton steel casting being very gradually cooled, the outside being warmed with coke fires until the inside has partly solidified, when the block is hammered into shape to form the main piece of an immense gun. The enormous array of furnaces, and the perfect manner in which such a large number of men—in some cases as many as eight hundred—all lift their eighty pound crucibles out of the furnaces and pour them into the mould in rapid succession, is described as a wonderful sight. The scrupulous care bestowed upon the minutest detail was a noticeable feature about their manipulation of steel. If, after extended trials, a certain practice or proportion of ingredients has been found to give the best results, that practice is absolutely and exactly adhered to, nothing being left to mere possibilities. Apropos of the above, the Pittsburg *Gazette* states that Andrew Carnegie and his partners pay out more money in wages every month than Krupp, the celebrated gun maker of Essen, Germany, disburses among his men. Krupp employs 10,000 men, and Carnegie's various Pittsburg mills are operated by 6,000 men. The difference in the aggregate of salaries is the difference between American and European pay. The monthly pay roll of the Pittsburg iron master is over half a million dollars. Eight of the Carnegie blast furnaces produce each day 1,500 tons of metal. For making a ton of any kind of metal it requires four tons of material, consisting of ores, limestone, coke, and in mill metal cinder is used, making for each day 6,000 tons of material handled. Estimating this immense amount at twenty tons, or 40,000 pounds, to a car, it would require the use of 300 cars. In addition to this, the firm finishes every day at least 1,000 tons, requiring fifty cars more. Besides this, 150 tons of unfinished old iron and raw steel are handled at Thirty-third Street. The liquid metal, 650 tons daily, handled at the steel rail mill is transferred in what are called ladles. In making an estimate fully within bounds, it is safe to say that 375 cars are required every day to handle the raw and finished material used by Carnegie's mill. Twelve engines, or one locomotive for every forty cars, each being thirty feet long, added to the 375 cars, would make a train of 12,380 feet, or more than two miles in length. For 300 days it would take 111,000 cars. This would make a train 3,330,000 feet long, which would reach over a distance of 630 miles—from Columbus to New York. The plants owned by the Carnegies cover 200 acres of ground. Upon this there are laid and maintained thirty-five miles of tracks, and the firm own twenty-two locomotives.

Beware of Draughts.

This is the time of year for colds, neuralgia, rheumatism, pneumonia, and kindred complaints. A little draught may produce either. A Spanish proverb runs as follows:

If cold winds reach you through a hole,
Go make your will and mind your soul.

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A Multitudinous Clock.

The renowned horologist of Villingen in the Black Forest, Christian Martin, has just completed a clock which, as a marvel of construction, probably surpasses all that has hitherto been achieved in the clockmaking art. The clock is three and a half meters high, two and three-quarters broad, and is set in a magnificent Gothic case. It shows the seconds, minutes, quarter hours, hours, days, weeks, months, the four seasons of the year, the years, and leap years until the last second of the year 99,999 A.D. The clock is not only chronological, but geographical, and shows the right time, by comparison, in every latitude of the northern and southern hemispheres. It records the successive phases of the moon; and it strikes the minutes as well as the quarters and hours.

The mass of automatic machinery in it will seem stupendous, even to those who have seen the splendid specimens of local Black Forest clockmaking in the public Clockmakers' Halls at Tribery, Furtwangen, and other places, and the great clock on the opposite side of the Rhine in Strassburg Cathedral. There are multitudes of working figures, representing the life of man, the creed of Christendom, and the old Roman and German mythologies. There are sixty different personages to strike the sixty minutes—the Guardian Angel, Death as a skeleton, the twelve Apostles, the ages of man, the four seasons, the twelve signs of the zodiac, the seven Teutonic deities—after which our days of the week are named—and many others.

During the night hours, winter and summer, a night watchman comes forward and blows the hour on his horn. At sunrise a cock appears and crows lustily. The cuckoo, the inevitable ornament of a Black Forest ideal clock, remains concealed in the works of Herr Martin's clock until spring. The great face of the clock has thirty-two distinct compartments. A whole series of movable pictures are exhibited in succession by the works—representing in turn the seven days of Creation and the fourteen "Stations of the Cross." A little sacristan rings a bell in the spire, and then kneels down and folds his hands. The musical works, always a great feature in the Black Forest clock, have a sweet, flute-like tone.—*Echo.*

IMPROVED SPRING WHEEL TRACTION ENGINE.

We illustrate an improved spring spudded wheel, by Messrs. J. & H. McLaren, Midland Iron Works, Leeds. The tires of the wheels are formed with openings, through which shoes are protruded by the action of spiral springs, in such a manner that two or more of these spuds of each wheel will bear at the same time upon the road. Fig. 2 shows a side view of a wheel fitted with spring shoes, and Fig. 3 a cross section of the same wheel.

The rim, A, of the wheel is formed with openings, B, through which the shoes, C, protrude. The projections are shown as being made in pairs, cast in one with a connecting piece, D, bridging the portion of the tire between two adjacent openings, and having a seat, upon which bears one end of the spring, E, the other end bearing against the piece, F, carried upon the bolt, G, furnished at its upper end with nuts, H, for adjusting the pressure of the springs, and at its other end with a crosspiece, J, engaging in a recess correspondingly formed in the part of the tire between two adjacent openings, B. It will be readily seen, say Messrs. McLaren, that "when the projections or shoes are arranged in more than one circumferential row, acted upon by independent springs, the wheel will accommodate itself to lateral inequalities of the road, as indicated by the diagram, Fig. 4."

"In Fig. 2, five of the shoes and part of the rim are shown touching the ground, so that all of them, more or less, share in taking the weight of the engine, whereby the said weight is distributed over a large area, and great tractive power is obtained, and the road is preserved from much damage. If desired, the springs, D, may be compressed by means of the nuts, H, to such an extent that the rim is always off the ground, whereby the advantage of a spring wheel is obtained, or if the pressure on shoes be applied by spring spokes from the boss, there is obtained a spring-carried engine."

This engine, says the *Mechanical World*, is very powerful, a load of 76 tons, viz., a marine boiler weighing 56 tons and trolly 20 tons, having been drawn by one of its class over the streets of Liverpool.

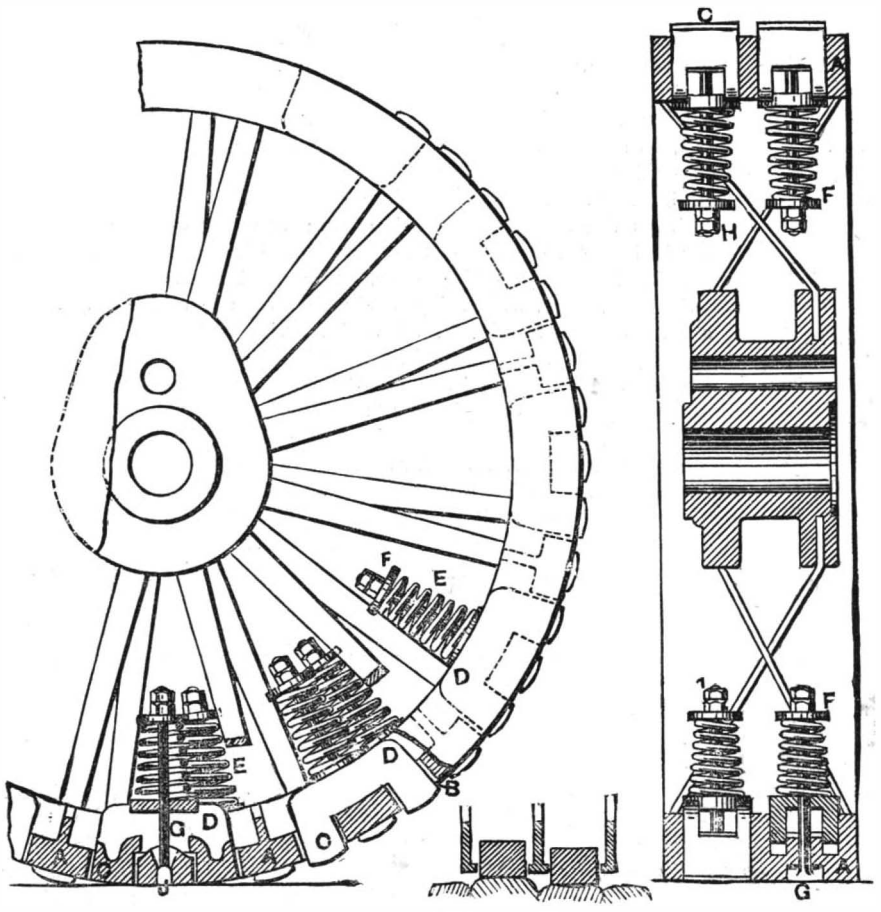
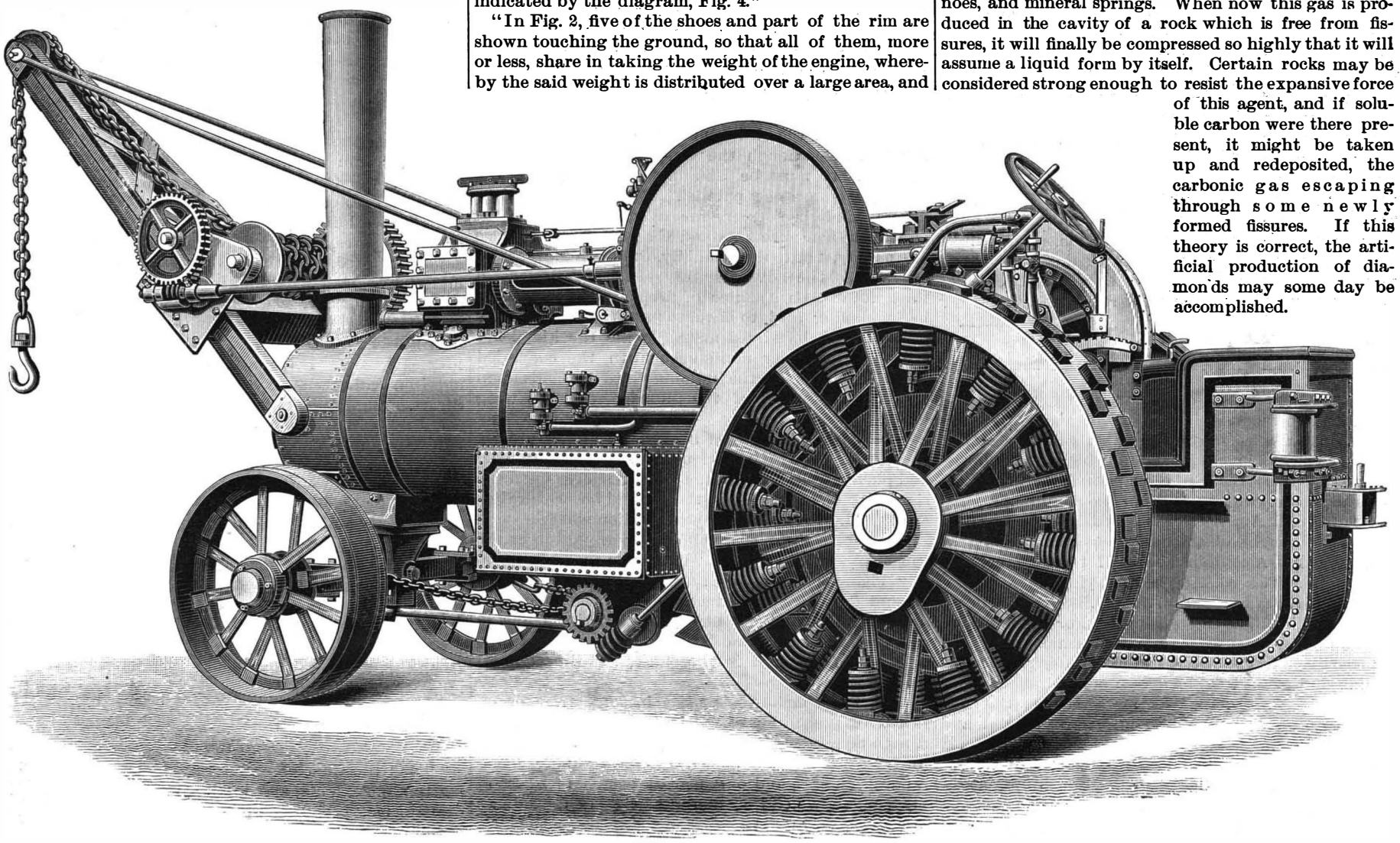


Fig. 2. Fig. 4. Fig. 3.

SPRING WHEELS FOR TRACTION ENGINES.

Formation of the Diamond.

Among the many theories existing as to the formation of the diamond, that of Professor Simmler, of Switzerland, is certainly not the least probable. The diamond often incloses cavities which, in some instances, contain a gas, in others a liquid. Sir David Brewster, who had given much attention to the subject, found, in investigating the nature of the liquid, that its refractive power is less, but its expansive power greater, than that of water. In comparing the results obtained by Brewster with those calculated for other liquids, Simmler found the numbers for the expansive and refractive power of the liquid referred to to coincide singularly with those for liquefied carbonic acid. But other facts observed by different savants tend to prove also the presence of this agent in the coating of the most valuable of gems. Upon the bursting of such crystals there often occur two liquids in the cavities, the one behaving like water, the other like liquid carbonic acid. On one occasion it was observed that the liquid in a quartz crystal which was dashed to pieces scattered its contents around with a great noise, burning holes in the handkerchief wound around the hands of the experimenter. The acid content itself had disappeared. Upon these observations Professor Simmler based his theory. If carbon be soluble in liquid carbonic acid, it would then only be necessary to subject the solvent to slow evaporation; the carbon would thereby be deposited, and, by taking proper care, assume crystalline forms. In evaporating quickly the so-called black diamond, which, in the state of powder, is much used for polishing, the colorless diamond might be produced. Though the liquid referred to has never been subjected to chemical analysis, the formation of liquid carbonic acid in the interior of our globe may, nevertheless, be considered as highly probable. In the gaseous form we know it to be evolved in immense quantities from fissures, volcanoes, and mineral springs. When now this gas is produced in the cavity of a rock which is free from fissures, it will finally be compressed so highly that it will assume a liquid form by itself. Certain rocks may be considered strong enough to resist the expansive force of this agent, and if soluble carbon were there present, it might be taken up and redeposited, the carbonic gas escaping through some newly formed fissures. If this theory is correct, the artificial production of diamonds may some day be accomplished.



IMPROVED SPRING WHEEL TRACTION ENGINE.

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SOME NEW FISHES.

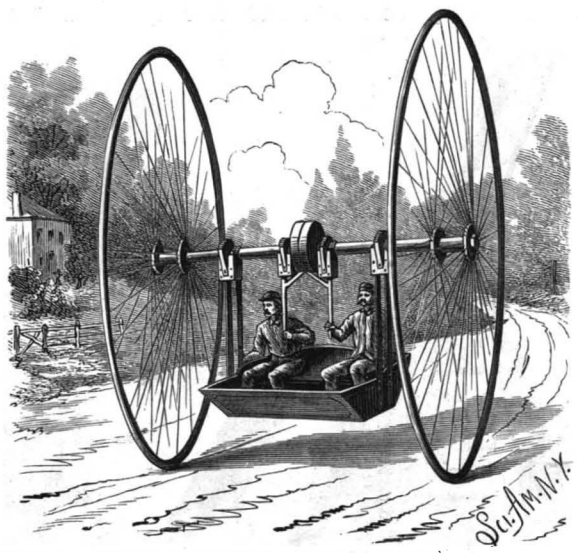
BY C. F. HOLDER.

During the past decade some extremely remarkable fishes have been added to the lists of those already known. Many of these are deep-sea forms, interesting and novel even to the specialist. The majority of these strange creatures were discovered by the Challenger and Talisman expeditions, the former having been sent out by the British government, while the latter was fitted out by France; and it is only fair to say that much has been accomplished by the United States Fish Commission in their dredging along our own shores, although the ground covered by the latter was extremely small when compared to that gone over by the large and fully equipped foreign expeditions.

Only a few years ago, naturalists were almost unanimous in the opinion that fishes could not live in the greater and abyssal depths of the ocean, and it seemed only necessary to mention the enormous pressure that must exist in deep water to show that they were right. Again, the argument was brought up that animal life could not exist below a depth where the sun's rays ceased to penetrate. These arguments have lost their force, however, in the light of recent discovery, and it is found that the very darkest and deepest portions of the ocean bed are peopled with animal life of some kind. How, then, can they withstand the pressure that powders glass in the instruments, hoists iron and copper, and rends and tears the ropes? A most casual examination of one of the extreme deep-sea fishes tells the story. Some, when taken from the water, actually fall to pieces; and although of large size, the types of oceanic carnivora, one and all, are adapted by a peculiar modification to their seemingly unnatural habitation. In short, these dwellers of the deep sea are literally put together in the flimsiest manner. Their bones are cavernous, porous, and apparently permeated with holes in every direction; so much so that a pin thrust at random into the bone will pass into one of these natural pits. In this way, the framework of the fish is enabled to withstand the enormous pressure. Water undoubtedly finds its way into all these crevices, and the pressure is equalized. Often the vertebræ are so loosely connected in large fishes that they drop apart when touched, showing how perfectly they are adapted to a life where the pressure amounts to two or three tons. The distribution of these fishes is interesting. Some genera are found at one level, say a mile, some at two miles, while others seem to rise and fall, passing from one level to another. This change, however, must be made very slowly, to enable the fish to adapt itself to its new surroundings. It is extremely difficult to realize the distances beneath the surface from which these fishes are taken. Imagine a body of water as deep as the distance between Tenth Street and the Arsenal building, Sixty-fourth Street and Central Park. Beneath that expanse of fluid (nearly three miles) is found the fish *Bathyophis ferox*. The genus *Echiostoma* lives at a depth of about two miles and a half from the surface. The naturalists of the Talisman dredged the fish *Alepocephalus rastralus* in water a mile and a half deep. The little luminous *Scopelus* was found in equally abyssal depths; *Lepidodermer macrops*, two miles; *Macrurus affius*, two miles and a quarter; and the list is a large one, many of the latter only visiting the depths given at times, and not having the fragile make up that distinguishes the true deep-sea forms. By the latter, I refer to those that habitually remain in the lower areas, such as the *Trachypteridæ*, *Plagyodus*, *Chiasmodus* (shown in the accompanying figure), *Melanocetus*, and *Saccopharynx*. These forms, though carnivorous, are often so fragile that they fall apart while being handled, and when compared with the surface fishes with which we are familiar, their bony and muscular parts seem but little able to stand the slightest exertion. The bones are extremely light, having very little calcareous matter in their make up, while the muscles appear to have degenerated to almost useless threads of tissue. From this it might be assumed that the fishes were delicate forms, not adapted for vigorous warfare. On the contrary, they are all carnivorous and rapacious in the extreme, undoubtedly moving about with great velocity, and preying upon their fellows in the deep sea.

Perhaps the most interesting feature in connection with some of these fishes is their manner of taking food or prey, and one of the most striking instances is shown in the accompanying figure, that represents the deep sea *Chiasmodus* swallowing a fish several times larger than itself. This would seem an impossibility, but even a casual examination serves to show that it is not more remarkable than the same thing in snakes.

The *Chiasmodus*, in the first place, is a luminous form, its fins and body at portions being covered with a layer or deposit of mucus that has the property of becoming luminous, so that the fish is a veritable finny lantern, and enabled to capture prey by its own light. Often the victims thus seized are several times the actual bulk of the eater, but, by a curious arrangement of the jaws, the enormous mouthful is easily mastered.



BROWN'S SWING BICYCLE.

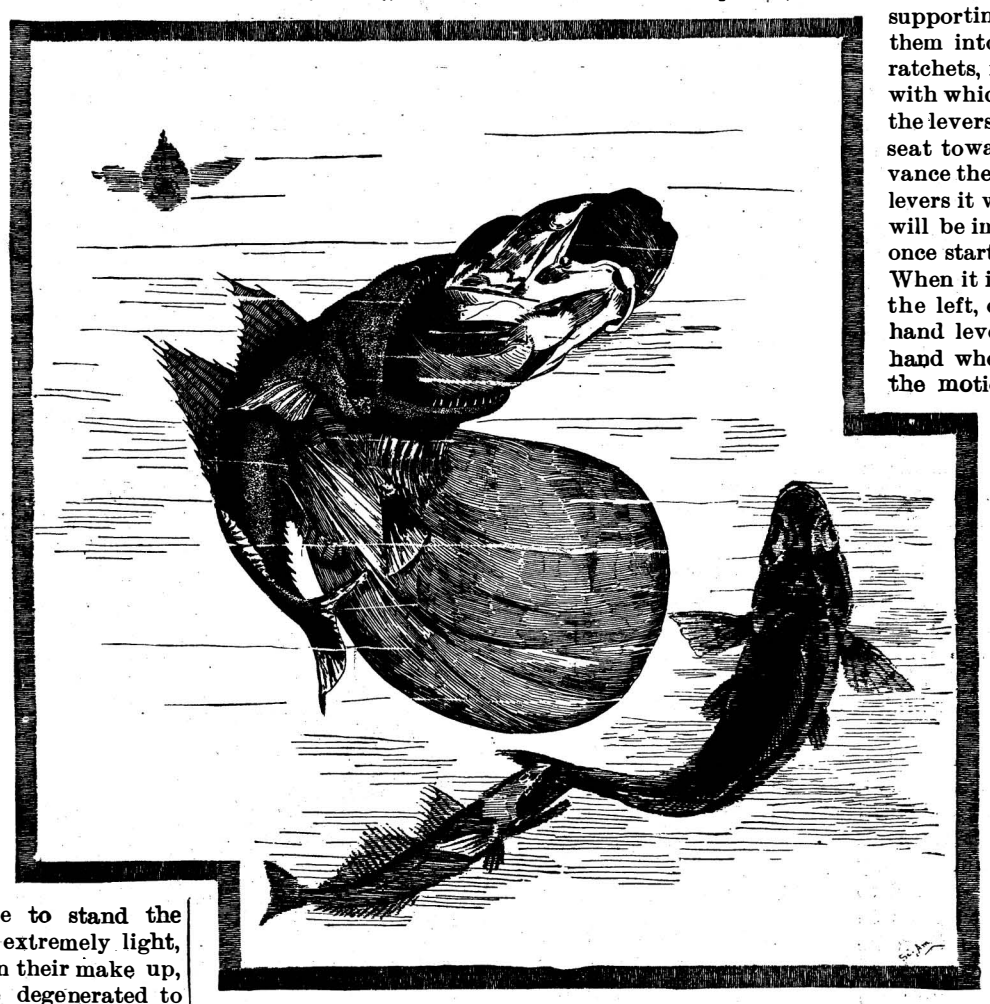
In ordinary fishes that we are familiar with, deglutition is performed "by means of the muscles of the pharynx," but in the *Chiasmodus* there is an independent and alternate movement of the jaws, that the reader has perhaps noticed in our common snakes. When the *Chiasmodus* secures a hold upon its victim, it probably lengthens out, and if we could witness the operation, we would observe one side of the jaw move forward, and then the other, each advancing a little at every turn, the teeth taking hold at every move; and if we imagine this repeated continuously, it must be evident that the animal so operated upon must be hauled hand over hand, as it were, into the stomach of the *Chiasmodus*. This is exactly what occurs. The *Chiasmodus* hauls itself over its victim. It is evident that a large stomach would be a necessary adjunct for such an operation, and this we find to a remarkable degree in *Chiasmodus*, *Melanocetus*, etc.; the organ when distended depending from them like an enormous pouch, its size increased probably by the gases that generate during digestion.

The deep-sea fishes are supplied with lights and feelers, with which to capture their prey, and the former peculiarity is one of great interest, showing that even the deepest recesses of the sea are not the gloomy spots generally supposed, but have their living moons and stars. In some fishes the luminosity appears from the mucous envelope at random over the body, in others it is confined to phosphorescent plates arranged here and there, or in groups. These organs have been described as "a sort of bi-convex transparent lens, closing externally a chamber filled with a transparent liquid. This chamber is furnished with a membrane of black color, formed of little hexagonal cells, much resembling the retina. It is connected with the nerves."

In *Scopelus* a luminous spot is seen, like a headlight, between the eyes, and in the deep-sea fish *Malacosteus niger*, extremely large plates are found directly beneath the eyes, while the *Stomias* has side plates. Equally strange are numbers of new fishes, as *Eurypharynx*, *Melanocetes*, and *Macrurus*, that seem to "run to head," that portion being extremely large and entirely out of proportion to the rest of the body. Thus, in the pelican fish, first mentioned, the mouth of the fish would hold its own body eight or ten times over.

The *Macrurus* is another strange form recently dredged. Its head and eyes are enormous when compared to the body, that dwindles away in an eel-like temination.

It is a matter of regret that the United States Government does not see fit to send out a well-equipped ship like the Challenger, so that our specialists might have as favorable opportunities as those of Europe. Some of the men-of-war lying at the navy yards might easily be fitted up for such work, and dispatched on a four or five years' cruise that would undoubtedly result in extremely valuable results to the nation and the cause of scientific education.



A SMALL FISH THAT SWALLOWS A LARGER FISH.

SWING BICYCLE.

The bicycle shown in the accompanying engraving is the invention of Mr. Nathaniel Brown, of Emporia, Kans. The wheels are secured to the outer ends of two hollow axles or shafts, which are mounted upon a central shaft, and are formed with ratchet wheels and friction disks. The seat is suspended by means of arms connected to centrally slotted straps passing over the axles; the ratchet wheels pass through the slots in the straps, and are engaged by spring pawls secured to the forward upper ends of the arms. In connection with each of the two other ratchet wheels is arranged a block, held to the hollow shaft by straps, and provided with a spring pawl engaging with the teeth of the ratchet. Pivoted in recesses in the lower ends of the blocks are lever arms, formed with inwardly extending fingers, arranged so that when the arms are swung toward each other upon their pivots, the fingers will be brought to bear against the faces of the friction disks.

The pulling of the levers downward starts the main wheels forward, and at the same time swings the seat forward, thus moving the pawls carried by the arms supporting the seat backward, and bringing them into engagement with teeth upon their ratchets, not so far advanced as were the teeth with which they were primarily engaged. As the levers are moved forward, the swing of the seat toward its normal position will act to advance the bicycle, and by so reciprocating the levers it will be seen that a pendulum motion will be imparted to the seat, which will, when once started, propel the machine for some time. When it is desired to turn the machine, say to the left, extra force is exerted upon the right hand lever, which will tend to drive the right hand wheel forward faster than the other; or the motion of the left hand wheel may be checked by moving the left hand lever so that its finger will bear against the friction disk. To stop the machine, both brakes are applied by moving the levers toward each other. The rider may stop at any desired point, when ascending a grade, and rest at ease, since any tendency of the machine to run backward would be counteracted by the weight of the seat.

Improved Telephone Wires.

The German Post Office is now using, to a considerable extent, the new anti-induction telephone cables made by Messrs. Felten & Guilleaume and others. The usual cable for overhead circuits contains wires of 27 to 30 mm. diam., each separately insulated, and wrapped on the outside with tin foil. The cable thus formed is surrounded with three naked copper wires, and sheathed with a lead covering. The whole is protected by a hemp taping and bitumen. These cables, when used for overhead circuits, are not strong enough to support themselves, and must be suspended from cast steel wires. The three naked copper wires, as well as the wrappings of tin foil, are all connected to earth. A smaller cable, containing only fourteen wires, is also manufactured. A large number of these cables are now erected throughout Berlin, and are used with satisfactory results.

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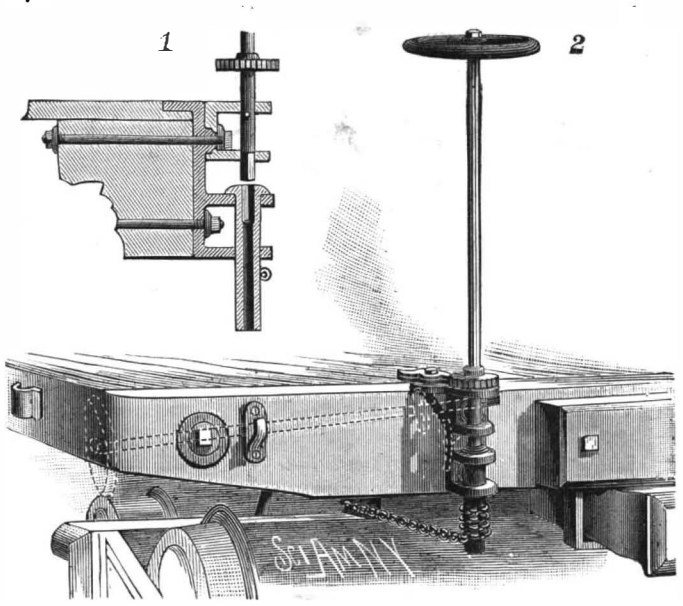
Substitute for Yellow Glass Panes in Orthochromatic Photography.

Writing in the *Photographische Correspondenz*, Carl Srna recommends the invention of Hugo Engler (Dresden) of a colored collodion stripped film, as a substitute for the colored plate glass now used. It has long been a recognized fact that it is possible to photograph objects and obtain some approximate color value without the use of a yellow pane of glass before the plate. Pre-eminently is this the case with erythrosin-silver bathed plates, now made known by Dr. Mallmann and Scolik. It must, however, be remembered that this rule applies only to cases in which no blue pigments have to be reproduced—in landscape photography, for instance, or in the reproduction of pictures in which blue tints have no special predominence. Where predominant, the insertion of the yellow pane is indispensable. The necessity of this yellow pane is, without doubt, one of the greatest troubles the orthochromatic photographer has to put up with. Placed either in front or behind the lens, it is a nuisance; for, supposing the object be focused before the insertion of the yellow glass, and the latter placed afterward, what is the result? Why, the rays of light are broken, and a perfectly fatal difference of focus is occasioned. Further, the thick plate glass now used absorbs a considerable amount of light, necessitating, of course, a protracted time of exposure. In 1885 Max Jaffe slightly improved upon this unsatisfactory arrangement by placing the yellow glass in the diaphragm slit. By this means the focal distance was considerably decreased. But even this method was rather a troublesome one, necessitating either the cutting in two of the lens or the widening of the diaphragm slit. By Engler's idea, however, it is possible to place yellow screens of every requisite size in a moment, with little cost and trouble. He replaces the yellow glass by stripped colored films of strong collodion. These cause no focal difference whatever, and by their use the time of exposure is greatly reduced, because of the small amount of light they absorb. The films are made in the following manner: A clean sheet of plate glass is first rubbed with powdered talc, and then in the ordinary way coated with a four per cent raw collodion, containing dimethyl orange or aurantia (amount according to judgment), and placed upon a level surface to set. As soon as dry, the film is removed from the glass and cut to the required sizes. The diaphragms of the lens are then brushed over with gum and placed upon the collodion film. By this means the yellow screen necessary is formed, and can be placed in with the diaphragm, to which it is, of course, attached without any necessity of altering the lens.—*Photo. News.*

IMPROVED CAR BRAKE.

The accompanying engraving represents an invention which has been recently patented by Messrs. M. T. Carson and J. D. Gurganus, of Whistler, Ala. The lower end of the brake staff is fitted to slide in lugs projecting from a cast metal block, pivoted so as to turn on a plate fixed by bolts to the end sill of the car, as shown in the sectional view, Fig. 1. Directly under the lugs of the block, the main plate is provided with lugs in which a revoluble socket is loosely fitted. In the upper end of the socket is a square aperture, in which fits the lower end of the brake shaft. The brake chain is attached to the lower end of the socket, so that when the latter is turned by the shaft the chain will be wound upon the socket for applying the brakes to the wheels. In the brake shaft, between the lugs, is placed a pin, which prevents the shaft being withdrawn from the block. The socket is made hollow, thereby relieving it of unnecessary weight, and making it stronger, and also insuring the constant clearance of dust from its aperture, to which the brake shaft is adapted. To a lateral lug on the block is pivoted a dog, which may be engaged with a ratchet wheel fixed to the shaft to hold the brakes applied in the usual way.

When it is desired to lower the staff, so as to leave the entire surface of the car unobstructed all around so that freight can be loaded or unloaded conveniently, it is only necessary to lift the staff so as to withdraw it from the socket, when it may be lowered into the notch of a bracket secured to the car sill, as indicated by the dotted lines in Fig. 2. Every part of the brake will then be below the plane of the top of the car. After loading the car, the staff may be swung up again until the pivoted block strikes a stop, when the staff may be lowered into the socket in position for operating the brake. It will be noticed that there are no small parts to get out of order or be lost, and that neither the shaft nor block can be unshipped.



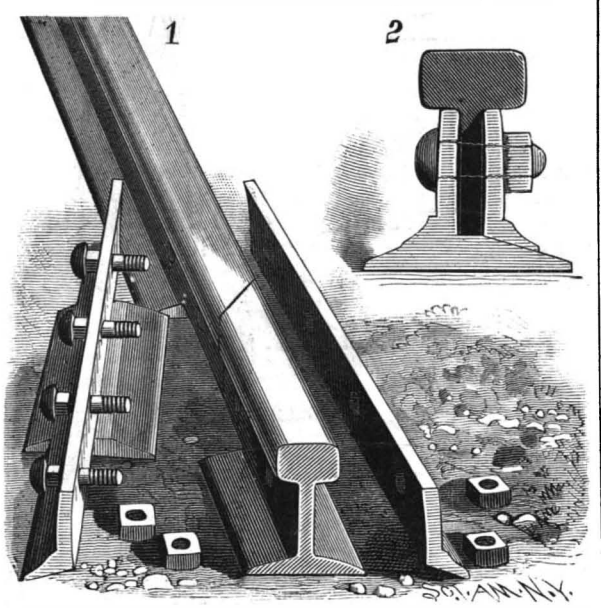
CARSON & GURGANUS' IMPROVED CAR BRAKE.

Petroleum in Amsterdam.

In our issue of January 1, brief mention was made of an iron reservoir being erected at Amsterdam for the storage of petroleum. The capacity was erroneously given as 1,740,000 gallons. It should have been 211,125.

IMPROVED RAILWAY RAIL JOINT.

In this joint the meeting ends of the rails are beveled so that they overlap one another, thereby forming a more continuous bearing for the wheels than does the ordinary style of squared ends. The heads and webs of the rails are cut at an angle of 45°, and a portion of the base of each, up to the web, is cut away at right angles to the rail. One of the fish plates, which are held to the rails by bolts passing through slots in the ends, is of the usual pattern, while the other is formed in the center of its lower edge with a flanged piece of the same shape as the base of the rail, and which fits in the recess formed by the cutting away of the end of the base of each rail. This flange forms a seat, upon which the ends of the rails rest. The form of the several parts is clearly shown in Figs. 2, 3, and 4, Fig. 1 representing the complete joint.



SIEGEL'S IMPROVED RAILWAY RAIL JOINT.

It is claimed that the use of this joint, the simplicity of which is apparent, will do away entirely with the jarring that now occurs as the wheels pass each joint, will permit increased speed, with less danger of accident, will lessen the wear and tear of the rolling stock, increase the life of the rails and of the ties under the joints, and reduce the liability of the ends of the rails spreading or getting out of shape, while the expansion and contraction of the rails will not have as much effect on travel as at present.

This invention has been patented by Mr. John Siegel, of Montreal, Canada.

Clearing Waste Pipes.

The annoyance arising from the stoppage of waste pipes in country houses, although very great, is but a small matter compared with the dangers which may follow obstructed pipes. The "sewer gas" about which so much has been written, and which is so justly dreaded, is not, as many suppose, the exclusive product of the sewer. Indeed, the foul and dangerous gases are not only found in the sewers themselves, but in the unventilated waste pipes, and those which are in process of being clogged by the foul matter passing through them. Any obstruction in the soil or waste pipes is, therefore, doubly dangerous, because it may produce an inflow of foul gas into the pipe, even though the entrance to the sewer itself has been entirely cut off.

The question is, how to get rid of the accumulations in pipes partly stopped or already closed. Digging up and cleaning out is a costly remedy, often ineffectual by reason of careless workmen. The second is the plumber's force pump, which is usually only a temporary relief.

In pipes leading from the house to the cesspool, there is a constant accumulation of grease. This enters as a liquid, and hardens as the water cools, and is deposited on the bottom and sides of the pipes. As these accumulations increase, the waterway is gradually contracted till the pipe is closed.

When the pipe is entirely stopped, or allows the water to fall away by drops only, proceed thus: Empty the pipe down to the trap, as far as practicable, by "mopping up" with a cloth. If the water flows very slowly, begin when the pipe at last empties itself. Fill the pipe up with potash, crowding it with a stick. Then pour hot water upon it in a small stream, stopping as soon as the pipe appears to be filled. As the potash dissolves and disappears, add more water. At night a little heap of potash may be placed over the hole, and water enough poured on so that a supply of strong lye will flow into the pipe during the night.

Pipes that have been stopped for months may be cleaned out by this method, though it may call for three or four pounds of potash. The crudest kind, however, appears to act as well as the best. If the pipe is partially obstructed, a lump of crude potash should be placed where water will drip slowly upon it, and so reach the pipe.

It is also well to fill the upper part of the pipe with the potash, as before, and allow hot water to trickle upon it. Soda and potash are both used for the purpose of removing greasy obstructions, and the usual method of application is to form a strong lye and pour it into the pipe.

It is better to put the potash into the pipe, because the water which it contains, instead of diluting, helps to form the lye. As water comes in contact with the potash it becomes hot, thus aiding in dissolving the grease. Potash, in combination with grease, forms a "soft" or liquid soap, which easily flows away; while the soda makes a hard soap, which, if not dissolved in water, would in itself obstruct the pipe.

When a pipe is once fairly cleaned out, the potash should be used from time to time, in order to dissolve the greasy deposits as they form, and carry them forward to the cesspool or sewer. The potash is very valuable for this purpose, because, in addition to its grease solving powers, it is exceedingly destructive to all animal and most vegetable matters.

The most dangerous gases appear to come from urinals and wash basin pipes, these in many cases seeming to be more foul than those from water closets. The decay of the soap and animal matter washed from the skin appears to be the source of the gases. The potash will be effective in keeping these pipes clear, and in this way may lessen the dangers.—*Artisan.*

Separating Fibers.

Hydrofluoric acid attracts water powerfully, and thus carbonizes vegetable fibers, leaving the animal fibers intact, if the acid used is not too concentrated. In using hydrofluoric acid in gas form, the goods have to be well soaked in water before being exposed to the acid. The latter process is carried on in chambers, which are made of suitable material, *e. g.*, lead, or else are lined with it. The acid is prepared from cryolith and sulphuric acid, and alum is obtained as a by-product. After the goods have been exposed for an hour, they are removed from the chamber, well washed with water, dried quickly in a drying chamber, and passed through a beater, where the carbonized vegetable fiber is separated in the form of dust. If a solution of hydrofluoric acid is used, wooden troughs, lined with lead, are employed; these are charged with water and either fluorspar or cryolith and the exact quantity of sulphuric acid which is required to liberate the hydrofluoric acid. The bath is kept at a temperature of 160° Fah., and the goods are left in it for an hour or two. They are then washed, dried, etc., as above. This process can be used for burring wool, or for recovering wool or silk from rags, etc., or for separating any animal fiber, as hair, from vegetable fibers.—*Industries.*

The Ideal Jeweler.

One of the greatest difficulties the jeweler has to overcome is that of obtaining original designs or ideas suitable for reproduction in the precious metals. Most of the household articles in common use have been thus reproduced in miniature, and the designer has ever to go further afield in search of novelties. Birds, beasts, and fishes, bicycles and steam engines, wooden shoes and warming pans, have all had their turn. We do not know that the electrical field has yet been trenched upon (excepting perhaps with regard to some few of the odds and ends connected with telegraphy); but with this exception, hardly an object exists that has not its diminutive counterpart among the jeweler's stock. The ideal jeweler should be an educated man in the strictest sense. He should unite the knowledge of the antiquary, the archæologist, and the architect in his own proper person; he should be at once chemist, metallurgist, geologist, and mineralogist; and have, at the same time, the qualifications necessary for a business man.—*W., J., and Silversmith.*

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SCIENCE IN TOYS.

V.

Among the many toys illustrating the phenomena of light, the simplest is the water bulb magnifier.

It consists of a small hollow sphere of glass filled with water and provided with a pointed wire arm for supporting the object to be examined. It is a Coddington lens lacking the central diaphragm. It answers very well as a microscope of low power, and illustrates the principle of refraction as exhibited by lenses. It receives the rays diverging from the object placed at its focus, and refracts them, rendering them convergent upon the opposite side of the bulb; but all of the rays do not converge exactly at one point, so that the image, except at the center of the field, is distorted and indistinct. This effect is spherical aberration.

WATER BULB MAGNIFIER.

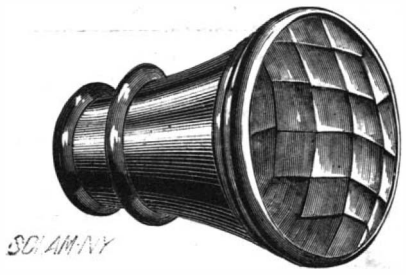
The prism is found in the list of toys as well as among scientific instruments. It decomposes light, recombines the dispersed beam, again forming white light. When placed in the sunlight, it yields a gorgeous spectrum. Even an ordinary prism may be made to exhibit several Fraunhofer's lines by arranging it in front of a narrow slit, through which a beam of sunlight is admitted to a darkened room. One side of the prism in this experiment must be adjusted at a very small angle with the incident beam. The spectrum will contain a number of fine dark lines, known as Fraunhofer's lines.

THE PRISM.

These lines tell of the constitution of the sun. The principle illustrated by this experiment is the one upon which the spectroscope is based.

A plano-convex glass, having a number of facets formed on its convex face, constitutes the toy known as the polyprism.

The facets form slightly different angles with the plane face of the glass, so that the rays are refracted differently by each facet, producing an image. One man seen through this instrument appears like a congregation. A coin viewed through it is multiplied as many times as there are facets, and a grate fire appears like the conflagration of a city.

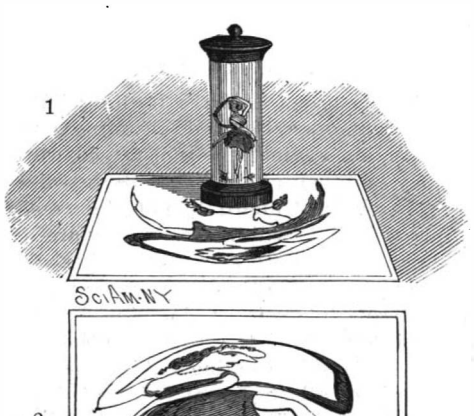


POLYPRISM.

The cylindrical mirror shows an ordinary object very much contracted in a horizontal direction.

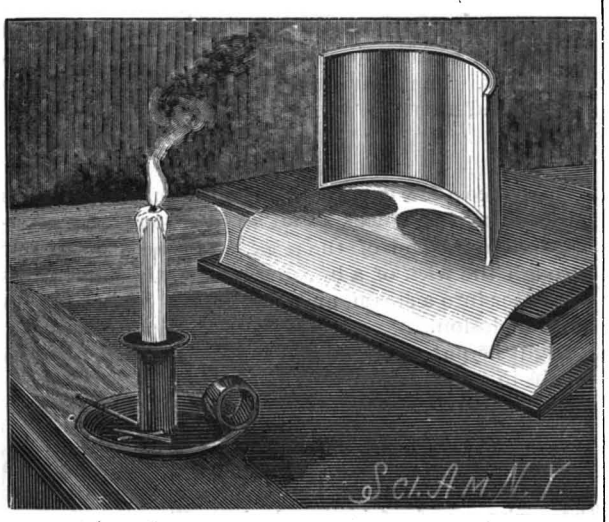
The pictures accompanying these mirrors are distorted to such an extent as to render the object unrecognizable until viewed in the mirror, which corrects the image.

By tracing the incident ray from any point in the picture to a corresponding point in the image in the mirror, then tracing the reflected ray from the same point in the mirror to the eye, it will be found that in this, as in all other mirrors, the simple law of reflection applies; that is, that the angle of incidence and the angle of reflection are equal.



1, CONVEX CYLINDRICAL MIRROR. 2, DISTORTED PICTURE TO BE VIEWED IN MIRROR.

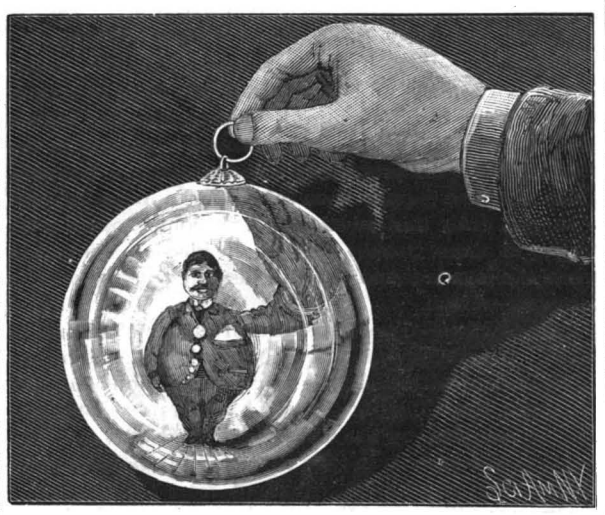
The concave cylindrical mirror in its behavior is the reverse of the mirror just described. It produces a laterally expanded image of a narrow picture, and while the convex cylindrical mirror disperses the light from a distant source, the concave mirror renders it convergent; but, as in the case of the water bulb,



CONCAVE CYLINDRICAL MIRROR, CAUSTICS.

the reflected rays do not focus at a single point, but cross each other, forming caustic curves. These curves may be exhibited by placing an ordinary cylindrical concave mirror edgewise on a white surface, and placing a small light, a candle, for example, a short distance from the mirror, as shown in the engraving. A concave mirror is not necessary to this experiment. The same phenomenon may be witnessed by observing a glass partly filled with milk, arranged in proper relation to the light. The inner surface of the glass serves as a mirror, and the surface of the milk serves the same purpose as the white paper. A cylindric napkin ring will show the curves under similar conditions. In fact, any bright concave cylindrical surface will do the same thing.

The convex spherical mirror distorts to a remarkable degree. A silvered glass globe held in the hand yields an image of the experimenter something like that shown in the engraving.



SPHERICAL MIRROR.

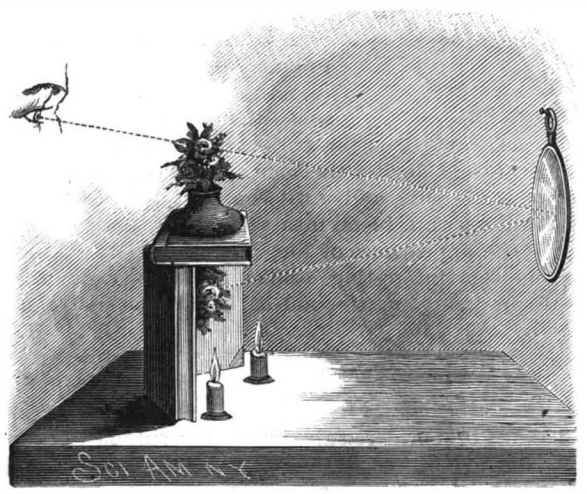
Those parts nearest the mirror are enormously exaggerated, while other parts are disproportionately diminutive.

The image in a convex mirror is apparently behind the reflecting surface, and always smaller than the object itself.

The spherical concave mirror produces effects which are the reverse of those just described; and while, in this case, as in the other, the *virtual* image appears behind the mirror, the image is a magnified one. The *real* image, which appears in front of the concave mirror, may be either larger or smaller than the object itself, depending upon the position of the object relative to the mirror and the observer. It is inverted, and is formed in the air. A candle placed between the center of curvature of the mirror and the principal focus forms an inverted image in air, which is larger than itself.

The phantom bouquet, an interesting and very beautiful optical illusion, is produced by placing a bunch of flowers (either natural or artificial) in an inverted position, behind a shield of some sort, and projecting its image into the air by means of a concave mirror. A magnifying hand glass answers the purpose, if of the right focal length, and a few books may serve as a shield. Two black covered books are placed upon one end and arranged at an angle with each other, and a third book is laid horizontally on the ends of the standing books. The bouquet is hung top downward in the angle of the books, and a vase is placed on the upper book, over the hanging bouquet.

The concave mirror is arranged so that the prolongation of its axis will bisect the angle formed by lines drawn from the top of the vase and the upper part of the suspended bouquet, and it is removed from the



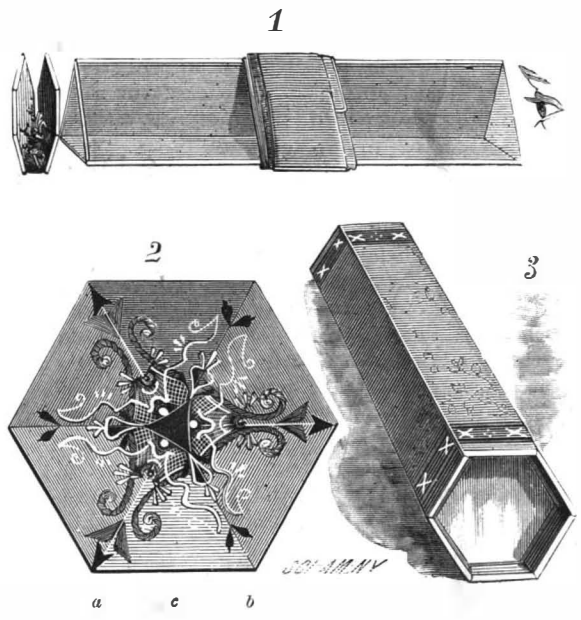
CONCAVE MIRROR.

bouquet and vase a distance about equal to its radius of curvature.

A little experiment will determine thecorrect position for the mirror. When the proper adjustment is reached, a wonderfully real image of the bouquet appears in the air over the vase. With a good mirror and careful adjustment, the illusion is very complete. The bouquet being inverted, its image is erect. A very effective way of illuminating the bouquet, which is due to Prof. W. Le Conte Stevens, of Brooklyn, is shown in the engraving. It consists in placing two candles near the bouquet and behind the shield, one candle upon either side of the bouquet. In addition to this, he places the entire apparatus on a pivoted board, so that it may be swung in a horizontal plane, allowing the phantom to be viewed by a number of spectators.

This simple experiment illustrates the principle of Herschel's reflecting telescope. In that instrument the image of the celestial object is projected in air by reflection and magnified by the lenses of the eyepiece.

The kaleidoscope is one of the most beautiful and inexpensive of optical toys. It can be purchased in the ordinary form for five or ten cents. It is sometimes elaborately mounted on a stand and provided with specially prepared objects. It consists of a tube containing two long mirrors commonly formed of strips of ordinary glass, arranged at an angle of 60°, with a plain glass at the end of the mirrors, then a thin space and an outer ground glass, the space being partly filled



1, PARTS OF KALEIDOSCOPE. 2, THE FIGURE. 3, KALEIDOSCOPE.

with bits of broken glass, twisted glass, wire cloth, etc. The mirrors may be arranged at any angle which is an aliquot part of 360°. When the mirrors, *a b*, are inclined at an angle of 60°, as in the present case, the number of images will be six, if the object, *c*, be counted as one.

The images adjoining the object are formed by the first reflections of the object. The images in the second sectors are formed by second reflections, and two coincident images in the sector diametrically opposite the object are formed by third reflections.

In most kaleidoscopes a third mirror is added, which multiplies the effects.

The zootrope, or wheel of life, is a common, but interesting, optical toy. It depends for its curious effects upon the persistence of vision. It consists of a paper box mounted on a pivot, and having near its upper edge a series of narrow slits, which are parallel with its

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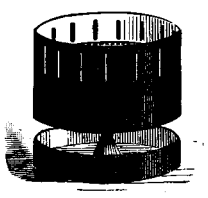
axis. Against the inner surface of the wall of the box is placed a paper slip, carrying a number of images of the same object arranged in as many different positions, each image differing slightly from the adjoining images, the successive positions of the several images being such as to complete one entire motion or series of motions.



ZOOTROPE.

When these pictures are viewed through the slits, as the box is turned, the eye glimpses the figures in succession, and retains the image of each during the time of eclipse by the paper between the slits and until the next figure appears. The images thus blend into each other, and give the figure the appearance of life.

Some very interesting studies for the zootrope have been produced by the aid of instantaneous photography. G. M. H.

Simple Chemical Experiments.

BLUE AND WHITE CRYSTALS.

Take ½ oz. powdered alum and ½ oz. sulphate of copper; dissolve in 1 oz. of boiling water; put into a glass tube or phial, and on cooling you will see the colorless crystals of alum are formed side by side with the blue crystals of sulphate of copper.

H. J. DEAN, Chesham.

TO ENGRAVE ON STEEL.

Requirements.—A box containing powdered cupri sulph., and labeled "The Powder."

Directions.—Dissolve some of the powder in a small quantity of water; rub the surface of the steel over with a piece of wetted soap, so as to cover it with a thin coating; then dip the point of a pencil into the solution, and with it write or draw the required design on the steel. After a few minutes wash, and the steel will be found to be beautifully and permanently engraved.

F. FREEMAN.

INVISIBLE INKS—BLUE AND BROWN.

Requirements.—Ferri sulph., labeled "For Blue Ink;" cupri sulph., labeled "For Brown Ink;" and potass. prussias flav., labeled "The Developer." They may also bear the Nos. 1, 2, and 3 respectively.

Directions.—Make separate solutions of Nos. 1, 2, and 3, and preserve in bottles for use. With a clean quill pen write with the solution of either No. 1 or No. 2, and allow to dry. The writing will remain invisible. Dip a feather or small brush into No. 3, or the "developer." The writing will then appear distinctly written—in blue if No. 1 ink has been used, or in brown if No. 2 was used. F. FREEMAN.

THE FLOATING BEACON.

Requirements.—A cardboard box containing a half dozen or dozen small pyramid-shaped pieces of camphor labeled "The Beacons."

Directions.—Take one of the beacons, place it on the surface of some *clean* water in a basin, ignite the point with a match. The flaming beacon will then commence darting about on the surface of the water, and will continue doing so till burnt out. F. FREEMAN.

BLOOD WRITING.

Requisites.—A pill box containing red iodide of mercury, and labeled "Magic Powder."

Directions.—Take some of the "Magic Powder," and rub it over the surface of a sheet of note paper with a piece of cork. Take the paper so prepared and hold it over the flame of a candle or lamp, slowly moving it to prevent burning. The red color will quickly disappear. Anything now written or drawn on the paper with a pointed piece of wood will appear as if written in blood.

F. FREEMAN.

SUN PRINTING—FOR TAKING TRUE COPIES OF TRACINGS, LEAVES, PATTERNS OF LACE, ETC.

Requirements.—Ferri ammon. cit., ʒ ij; liq. potass. ferrocyanid., ʒ ij; aquæ dest. ad ℥ ij. M. ft. sol. Sig.: "The prepared solution." "To be kept in the dark." Inclose camel hair brush.

Directions.—By candle light take a sheet of writing paper and brush one side of it over with the solution; hang it up to dry in a dark room or cupboard. When dry, place the object to be copied next the prepared surface, in a printing frame; then expose to direct sunlight for a few minutes till the prepared paper has turned gray; take it out and wash the paper in clean water; the printing will then become permanently fixed. Instead of a printing frame, the object and paper may be inclosed between a piece of glass and flat wood tightly bound together. F. FREEMAN.

THE SKELETON IN THE CUPBOARD.

Requirements.—A bottle of phosphorized oil, labeled "The Phantom Light," and a small brush, packed in cardboard box.

Directions.—Get a large sheet of paper, and then, with the aid of the brush dipped into the phantom light, roughly sketch the outline of the human skeleton; then attach it to the wall in an empty cupboard, shut the door, take your friends into the room in which the cupboard is (the room being quite dark), and ask one of them to go to the cupboard. He will, no doubt, run back greatly alarmed. Other devices may be adopted at the will of the operator. F. FREEMAN.

BEAUTIFUL CRYSTAL ORNAMENTS.

Requirements.—Various boxes containing the following powdered chemicals: Ferri sulph., cupri sulph., alum sulph., pot. bichrom., potassæ nit., and common salt.

Directions.—Dissolve any one of the powders contained in the box in some hot water, so as to form a strong solution, pour the solution into an open tumbler. In the solution now suspend a piece of coke, a clinker, or any ornament with a rough surface; allow it to remain suspended a few days, and as the liquid evaporates, beautiful crystals will form and continue to grow on it. The color and appearance of the crystals will depend upon the salt used.

F. FREEMAN, West Dulwich.

NIHILIST BOMBS.

Introduce a few drops of water into some small glass bubbles, having a neck about an inch long, and afterward close the end of the neck. This neck being put through the wick of a burning candle, the flame boils the water into a steam, and the glass is broken with a loud explosion.

Might be put up in small cardboard boxes, a dozen bombs in a box, labeled "Nihilist Bombs," with directions inclosed. GEO. E. PEARSON, Northallerton.

FACIAL TRANSFIGURATOR.

Dissolve some salt and saffron in spirits of wine, dip a little tow in it, and set fire to the tow. By this light those who are of a fair complexion will appear green, and the red of the lips and cheeks will turn to a deep olive color.

Might be put in a 1 oz. bottle, and packed in cardboard box with directions and fancy label, labeled "Facial Transfigurator."

GEO. E. PEARSON, Northallerton.

LUMINOUS BOTTLE OR WATCH LIGHT.

Place a piece of phosphorus the size of a pea into a long glass phial, and pour boiling oil carefully over it till the phial is one-third filled. The phial must be carefully corked, and when used should be unstopped a moment to admit the external air, and closed again. The empty space of the phial will then appear luminous, and give as much light as a dull ordinary lamp, and just sufficient to see the face of a watch. Each time that the light disappears, on removing the stopper it will instantly reappear. In cold weather the bottle should be warmed in the hands before the stopper is removed. A phial thus prepared may be used every night for six months.

GEO. E. PEARSON, Northallerton.

TO COAT COPPER WITH SILVER, IRON WITH COPPER, AND TIN WITH IRON, FROM ONE SOLUTION.

Directions.—Pour half the solution from the bottle into a wine glass and put into it the piece of copper wire; it will in a few minutes become coated with a thin layer of silver. If it is allowed to remain in the solution until the previously colorless solution becomes green, and the copper then taken out, a piece of iron wire put into the solution will become coated with copper in about twenty minutes; a piece of zinc put in when the iron is taken out will become covered with a thin coat of iron.

Explanation.—The first solution is one of nitrate of silver. When copper is put into it, it is attacked by the nitric radical (nitric acid), and forms a solution of nitrate of copper, throwing out the silver which previously was held in solution by the nitric acid. Iron put into the solution of copper is in turn attacked by the nitric acid and leaves a solution of nitrate of iron, throwing out the copper. Zinc put into this solution is attacked, and leaves a solution of nitrate of zinc, throwing out the iron.

Materials Required.—Make a solution of nitrate of silver, gr. xx to ʒ j, put it into a 1 oz. phial, labeling it "Poison." Wrap round the bottle a paper descriptive of the experiments, etc. (as above), and also advertising other experiments and their prices. Wrap up the pieces of copper wire, iron wire, and zinc with the bottle, put all into a cardboard box, and label outside: "Christmas Novelties. Chemical experiments free from danger. How to cover copper with silver, iron with copper, and zinc with iron, all from one solution. Price, 1s. (Name and address.)"

R. A. BELLAMY, Bedale.

A MYSTERIOUS EGG; OR, HOW TO PUT AN EGG INTO A BOTTLE.

Directions.—Soak an egg in the liquid, when it will gradually become soft; it may then be put into a bottle whose neck is very small. When washed well with cold water, it will again become hard, and will much astonish any one not in the secret.

Explanation.—When an egg is soaked in acetic acid, it becomes softened, and may be pressed into any form. Water will again harden it.

Acid, acet. fort., and aqua, equal parts, in a 6 oz. bottle, labeled materials, "The egg conjuring liquid." Wrap round a paper containing description, and advertising other experiments, put into box as in experiment No. 1, and label outside: "Christmas Novelties. Chemical experiments free from danger. Price, 6d. The Mysterious Egg; or, how to put an egg into a wine bottle without breaking either the egg or the bottle." R. A. BELLAMY, Bedale.

TO GET AN EXACT COPY OF ANY COIN OR METAL; AND HOW TO MAKE A SEAL OR ANY DEVICE IN COPPER.

Directions.—First take the impression of the medal to be copied by softening the wax before the fire, and carefully pressing it on the coin; when it is cold, remove it cautiously, and cover it thinly, but completely, with a covering of black lead. Pour the solution into the bath (one solution to each side); put the zinc plate into the colorless liquid, and attach to the other end of the copper wire the wax impression which you wish to copy, and allow it to dip into the solution of sulphate of copper, taking care that the wire is in contact with the black lead. In the same way you can cut any device, initials, etc., into the wax, and coat with copper.

Explanation.—This experiment is really depositing copper on the impression by electricity, the electricity being produced between the two solutions through the porous division. Care must be taken to have a good connection between the copper and the black lead on the impression, the black lead being a conductor of electricity and the wax not. The slower the copper is deposited, the firmer and harder will be the resulting deposit.

Materials.—A fully saturated solution of sulphate of copper crystals (about 6 or 8 oz.), and about 6 or 8 oz. of acid sulph. (1) and aqua (3) for the other side. A small wooden box lined with pitch, with a thin cardboard partition in the middle. A piece of zinc about 2 in. by 1½ in., with a piece of copper wire soldered on and bent over the partition, to hold the impression in the sol. of cupri sulph. A piece of wax (preferably a thin sheet). A camel hair pencil and some powdered black lead. Put the solutions in bottles, and the other things in the box; wrap up, with the particulars of the experiment, and advertising other experiments. Label: "Christmas Novelties. Chemical experiments, free from danger. Price 1s. 6d. Complete apparatus to take an exact copy of any coin or medal. To make a fac simile seal, or produce in solid copper any desired device or image." R. A. BELLAMY, Bedale.

WHAT HOLDS IT UP?

Materials.—A small tumbler or ale glass, a bit of sponge, and methylated spirit.

Directions.—See that the hand is large enough to well cover the mouth of the glass, moisten the bit of sponge with spirit, light it, and drop it into the glass, which at once cover with the naked hand. The flame will be immediately extinguished, but the glass will remain suspended to the hand, without any visible support. Unless the glass is jerked it will require a strong, steady pull to free it from the hand.

ARCHIBALD PATERSON, 133 Govan Road.
—*Chemist and Druggist.*

Mr. Beecher on English Railways.

Rev. Henry Ward Beecher has been talking to a reporter about traveling in England, and in reference to a query as to whether he enjoyed it, said:

"No. The railroads themselves, their bridges, their stations, are incomparably better than ours. They seem as if built for eternity. But there it ends. The cars are short, so that they have but six wheels, two here, two there, and two beyond, and one is, obviously of necessity, always over a grinding iron wheel. Then they oscillate so that they almost always make one seasick, and always give a feeling of nausea. My test consists in conversation and reading, and I found that in the one I had to raise my voice, and in the other my eyes became tired, and it was impossible for me to read with any degree of comfort. Now, here I do both with perfect ease. My eyes are strong and I am well, but I could neither talk nor read in the English cars. American cars would be very much better. There are a few palace cars over there, but they are not popular as yet. There is but a faint beginning of comfort for the engineers and stokers. For a long time they have been compelled to do their arduous work exposed to the elements; and even now they have nothing but a glass frame over them, open in front, affording a most imperfect protection against the moist, cold, chilly climate, so they bundle up like so many mummies. It is the same way on the Cunard line of steamers. They are so afraid the pilots will be lazy if they are afforded any conveniences or comforts, that they keep them exposed at the wheel. The English people are very slow to accept improvements in engineering, but they are very prolific in invention, too. I saw in the Liverpool Exposition some most interesting and instructive sights, such as models of all the great ships of the various lines, and some of the finest castings that those wonderful mechanisms demand—duplicate shafts and cranks built for great ocean racers."

THE acquisition of learning without study is like the acquisition of wealth without labor. It is as necessary for the mechanic to study out his problem when it comes to him to be studied as it is for him to finish his task by his handicraft.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Jackson J. Kennedy, of Cleveland, Tenn. This invention relates to former patented improvements of the same inventor, and consists mainly in improved construction of the drawhead, its locking key and its bearings, the drawhead being also more readily adjustable to couple with cars of different heights.

A steering apparatus for traction engines has been patented by Mr. James F. Smith, of Andrew County, Mo. The invention consists of a toothed arm connected with the front axle, with a device for imparting a turning motion to the arm in either direction by suitable means operated from an engine attached to the traction engine, with various novel parts and details.

A motor attachment for centrifugal pumps has been patented by Mr. Barton W. Scott, of Logansport, Ind. This invention covers a novel construction and arrangement of parts whereby it is intended to utilize the power of the water issuing from the periphery of the centrifugal pump wheel for assisting in the propulsion of the pump, considerable force being ordinarily wasted from the velocity with which the water is discharged.

A feed water regulator has been patented by Mr. Derwin E. Butler, of Chesterfield, Fulton County, Ohio (said Butler deceased; Aurelia O. Butler, executrix). A water tank is so connected with the steam space of the boiler that, when the water level of the latter falls below a certain point, the steam will exert its pressure upon the water in the tank to cause water to flow into the boiler, the construction being simple and the operation automatic.

A car coupling has been patented by Mr. George J. Ferguson, of Greenville, Texas. Its construction is such that the coupling may be manipulated from either side of or the top of the car, and by hand, and the devices may be locked in or out of couple, so that a through train may be locked coupled, when no accidental uncoupling can occur in transit, while the coupling does not require any greater length of drawhead than that commonly used, with various other novel features.

A car door forms the subject of two patents issued to Mr. George J. Ferguson, of Greenville, Texas. The object in one invention is to provide a simple construction by which the door, in open and closed positions, may be pressed firmly in against the side of the car, and will perfectly protect the contents of the car from the weather, the joint it makes not being affected by any jarring. By the other invention a construction is provided, intended mainly for grain cars, in which the door may be firmly pressed against the bottom of the car and fastened, so it will not shake loose in making a trip, may be easily started in opening, and will be efficient and durable.

MECHANICAL INVENTIONS.

A hammer attachment has been patented by Mr. William K. Howes, of Strong, Me. It is secured to the handle by means of pivot screws, and is for aiding in driving a nail in a position ordinarily out of reach of the operator, providing means for holding the nail and striking it a first sharp blow, leaving it in a position to be conveniently driven by blows as ordinarily given.

A shuttle box operating mechanism for looms has been patented by Mr. John Zimermann, of Philadelphia, Pa. It is for hand looms for weaving carpets and other fabrics, and is a combination of drop boxes, their suspending cords or ropes, a link connecting the cords and the jacquard and its lever, with a plate provided with levers and pins, with various other novel features, whereby the drop boxes are shifted automatically with very little effort on the part of the operator.

A carding machine forms the subject of two patents issued to Mr. George Bebb, of Indianapolis, Ind. The first invention relates to machines for carding woolen and cotton fiber, and has for its object to keep the doffer free from dirt and short fibers, which are liable to accumulate in the wire card clothing, the device being designed to work automatically, without interfering with the regular operation of the machine. The second invention provides further for discharging the dirt and very short stock into a trough or other receptacle, while the longer fibers will be returned to the doffer to be incorporated with the lap.

AGRICULTURAL INVENTIONS.

A hay loader and stacker has been patented by Messrs. Martin C. and John M. Isom, of Hoosier Prairie, Ill. The invention consists of a novel construction and combination of parts, in which are runners, a crane post with swinging crane, an inclined hay ladder with horizontal platform at its upper end, a hoisting rope and hay fork, with other novel features.

A fertilizer distributer and seed planter has been patented by Mr. Decatur Morgan, of Camden Court House, N. C. The seed is covered by a harrow, and the construction is such that the harrow will not be operated when no fertilizer is being distributed, while the machine can be readily turned around and drawn from place to place without wasting the fertilizer or being inconvenienced by the harrow.

MISCELLANEOUS INVENTIONS.

A windmill attachment has been patented by Messrs. Joseph Greenwood and William Hill, Jr., of Limestone, N. Y. This invention relates to attachments for increasing the length of the stroke, particularly in connection with pumps, and also to so balance the rods used to impart and receive power that their weight will not retard the movement or interfere with the operation of the windmill.

A muffin platform has been patented by Mr. Beth Baker, of Colorado Springs, Col. Combined with side bars formed in sections and united by hinges are cross bars hinged at each end to the side bars, there being a folding frame with trucks or ways, a truck to be mounted on the ways, with other novel features, to facilitate placing and lowering the casket into the grave, the invention being an improvement on a former patented invention of the same inventor.

A sliding gate has been patented by Messrs. Daniel E. James and Edward Lazenby, of Compton, Cal. This invention covers a style of gate which can be opened and shut without getting out of one's carriage or wagon, being opened by an operating cord on one side, and closed by means of a similar cord on the other side after passing through, while the pulleys, operating cords, etc., are thoroughly protected from snow and rain.

An attachment for cooking stoves has been patented by Mr. Eugene Nifenecker, of West New Brighton, N. Y. It consists of a hood or cover with a hinged door and an inner flue, with a grate bottom attached to the cover and a frying pan held in place on the grate bottom in the cover, and removable from the grate bar, the device being designed to carry off all vapors, odors, and smoke arising from boiling and frying.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Metallic Pattern Letters and Figures to put on patterns of castings. Knight & Son, Seneca Falls, N. Y.

The new "Trautwine's Curves" is an exceptionally handsome book. *Engineering News*, July 3, 1886, says it "is probably the most complete and perfect treatise on the single subject of railroad curves that is published in the English language."

The illustrated circular of J. F. Mancha, Claremont, Va., offers tempting inducements to settlers in his flourishing Claremont Colony, on James River.

For Sale—Foundry, machine, blacksmith, and woodworking establishment. Brick building, 103 x 200; iron roof. Switch to shop; boats land at door. Splendid place for manufacturing. All kinds of iron and woodworking machinery running on job work now. $7,500; $1,500 cash; balance, long time. Write for particulars. "W.," box 26, Jefferson City, Mo.

Manufacturers' Advertising Bureau. Benj. R. Western, Treas., 8 Broad St., N. Y. Managers of advertising for firms. 20 years' experience.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Patent for sale. G. A. Wright, Concordia, Kas.

Perpetual motion discovered. E. Hall, Middleville, N. Y.

Telescope Lenses. Lowest prices. Gardam, 36 Maiden Lane, N. Y.

For Sale—32 in. by 60 in. vertical or beam engine; Woodruff & Beach make; 7½ ft. by 8 in. shaft; pulley in sections, 18 ft. dia. In very good order. Estimated weight, 28 tons. Price, F. O. B., near Albany, N. Y., $1,000. S. C. Forsaith Machine Company, Manchester, N. H.

Wanted—To manufacture on royalty patented articles capable of being made in tin or other light metals. Reardon & Ennis, 311 River Street, Troy, N. Y.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Protection for Watches.

Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles, Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Concrete patents for sale. E. L. Ransome, S. F., Cal.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Curtis Pressure Regulator and Steam Trap. See p. 45.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Inventors wishing to sell their inventions, address, with particulars, Chas. Babson, Jr., 24 Congress St., Boston, Mass.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co. 419 East 8th Street, New York.

Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Safety Elevators, steam and belt power; quick and smooth. D. Frisbie & Co., 112 Liberty St., New York.

Mr. O. Frink, 234 Broadway, New York, publishes a neat little pamphlet describing the common forms of hernia or rupture, and explaining how all cases can be quickly cured by FRINK'S RUPTURE REMEDY. A copy will be mailed, in a plain, sealed envelope, to any address upon request.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

The Ingersoll Drill, see page 83, was patented in the U. S., Can., Eng., Fr., and Ger. by W. R. Stevens. Patent Attorney, 705 G St., N. W. Washington, D. C., agent for sale of the machines and patents. Send for catalogue.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) M. R. asks what tutia alexandrina is. A. It is commercial zinc oxide, and can be procured at any paint store.

(2) W. B.—Sulphur soap in baths is considered beneficial for skin diseases. Turkish baths may be taken in winter and for the catarrh. See the cure given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 216.

(3) D. A. C. asks how to make "marsh mallows" (a candy). A. Dissolve one-half pound of gum arabic in one pint of water, strain, and add one-half pound of fine sugar, and place over the fire, stirring constantly until the sirup is dissolved and all of the consistency of honey. Add gradually the whites of four eggs well beaten. Stir the mixture until it becomes somewhat thin and does not adhere to the finger. Flavor to taste, and pour into a tin slightly dusted with powdered starch, and when cool divide into small squares.

(4) H. F. J. writes: Some time ago I read of a drug to use on cotton to put in the ears to prevent hearing. It was said to be used by a man who had to sleep in the daytime where there was considerable noise, and not to be injurious. Is there any such drug, and if so, what is it? A. Cotton alone should be sufficient for any rightful use. It is exceedingly ill advised under such circumstances to use drugs to produce sleep.

(5) W. S. C. asks some way to remove the soot from a smoke stack 50 ft. tall, that is constantly annoying us by catching fire. Why is it that the soot forms and sticks to the walls of the stack more in the winter than summer? A. You probably burn wood which generates pyroligneous acid vapors, that condense upon the walls of the chimney and cement the unburnt carbon in the smoke. More condensation occurs in winter than in summer, from the greater cold, and hence greater accumulation of soot. There is no remedy but to burn anthracite coal, or sweep the chimney often.

(6) H. B. B.—There is no general proportion of height to length and number of panels applicable in bridge building. The weight to be carried, its kind, whether railroad is single or double track, whether there be also a common road, single or double, or with passenger walks, probable wind force, etc., are prime factors in establishing the height and length of panels. While the length of bridge is always a fixed measure, the quality and strength of material is a modifying and variable factor. In working out the details of strains to meet the requirement of assumed service, engineers may vary the details of construction and proportions to suit their individual judgment.

(7) W. C. T. desires a process by which he can bleach tallow (make it white) without interfering with its use for culinary purposes. A. We recommend simple boiling with its own volume of water, as there is a strong and well-founded prejudice against the use of chemicals.

(8) J. A. H.—For an acoustic telephone you may use a fine copper or galvanized iron wire, stretched between the required points, with each end attached to the center of thin disks of tin, about 1 in. in diameter. This may be done by soldering a small eye to the tin and twisting the wire in the eye. The disks are supported by drumheads of tightly stretched parchment somewhat funnel shaped, the disk lying against one side of the parchment and the wire extending from the other, and the parchment receiving the strain of the line wire. Avoid turning sharp corners. If necessary to make a turn, use radial slings of marline placed on outside of curve, attached to a solid post or a house.

(9) R. M. A. desires a cement that will hold tortoise shell together, also hold it to steel or brass. A. Take of mastic 30 parts, shellac 90 parts, turpentine 6 parts, spirits of wine, 90 per cent strong, 350 parts.

(10) B. F. R. asks (1) a recipe for a good "stomach bitters." A. Grind to a coarse powder ½ pound cardamom seeds, ½ pound nutmegs, ½ pound grains of paradise, ½ pound cinnamon, ¼ pound cloves, ¼ pound ginger, ¼ pound galanga, ¼ pound orange peel, ½ pound lemon peel; then macerate with 4¾ gallons 95 per cent alcohol, and add a sirup made of 4½ gallons water and 12 pounds sugar, then filter. 2. What is the most wholesome food for man? A. See "Cost and Nutritive Value of Foods," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 124.

(11) A. L. S. asks how to make retouching pencils in small quantities, such as used by photographers in touching negatives. A. The pencils consist principally of metallic lead to which a small quantity of antimony has been added to bring about the requisite softness. You will find it much cheaper to purchase them ready made than to attempt their manufacture yourself.

(12) J. J. D. asks: 1. What composition is used by hardware manufacturers to make paper labels adhere to iron, and what is it composed of? A. Use a dilute solution of white gelatine or isinglass, in the proportion of about one to twenty. For receipts of cements see the collection given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(13) T. H. asks: 1. What is fusel oil? A. It is the offensive, strong smelling oil produced along with the alcohol during the fermentation of grain, potatoes, etc., when conducted on a large scale. 2. How can it be detected when mixed with whisky? A. Only satisfactorily by chemical analysis. 3. What effect does it produce on those who take it, when mixed with whisky? A. The injurious effect of whisky is due largely to an excess of this ingredient, and such whisky is much more poisonous than that which is comparatively free from it.

(14) J. H. asks: Is there any gun whose range is said to be 15 miles, in the United States, Europe, or elsewhere? If not, state longest range that is now claimed. A. We believe there is no existing gun having a range of 15 miles. The longest range are the Bange guns, which are capable of throwing their projectiles 10 miles.

(15) H. B. asks: 1. What is the proportion of sulphuric acid to bichromate of potash in the solution for single fluid battery? A. For electropoion fluid for single cell battery, the following is recommended: One gallon sulphuric acid to three gallons of water. After it is perfectly cold, add to it a solution of six pounds bichromate of potash in two gallons boiling water. Use when cold. 2. What must be the proportion in case chromic acid takes the place of bichromate of potash? A. For chromic acid use about the same proportions. This will dissolve in cold water, or directly in the acid after full dilution. If the chromic acid is of theoretical strength, you could use one-third less than of the bichromate. 3. What are the formulæ in which the chemical action of the second case is expressed? A. 1st. $Zn+H_2SO_4=ZnSO_4+2H$. 2nd. $6H+2H_2CrO_4+3H_2SO_4=Cr_2(SO_4)_3+8H_2O$.

MINERALS, ETC.—Specimens have been received from the following correspondents, and have been examined, with the results stated.

P. P. B.—The specimen is limestone containing pyrite.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

January 18, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Addressing machine, I. D. Hurlbut	356,130
Adjustable seat, C. C. Gould	356,403
Advertising device, T. W. Lippincott	356,408
Advertising show stand, L. F. Wetzell	356,235
Ant trap, F. A. Mays	356,256
Awning and blind, combined, W. H. Jolliffe (r)	10,798
Axle box, car, M. Randolph	356,333
Axle lubricator, car, H. H. Buffum	356,272
Bag holder, F. Haydon	356,198
Barrel making machine, F. W. Ulrich	356,217
Basket, W. H. Belknap	356,301
Battery. See Voltaic battery.	
Bed bottom, O. S. & W. S. Foster	356,114
Bedstead attachment, hospital, C. Drake	356,352
Bicycle, C. A. Bouck	356,095
Bicycles, lantern supporting arm for, W. L. Fish	356,112
Bit stock, H. Smiley	356,214
Blackboards, composition for, J. Jameton	356,363

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Boats, compressed seam for, N. S. & E. R. Bowdish ... 356,096
Bogie, Brown & Midelton ... 356,347
Boiler. See Domestic boiler. Steam boiler.
Boiler furnaces, shield for, W. Madden ... 356,285
Book index, F. Rosewater ... 356,334
Boot or shoe-nailing machine, H. Dunham ... 356,107
Boring tool, H. M. Knight ... 356,138
Boring wood or metal, machine for, H. F. Bundy ... 356,098
Bottle stopper, T. Sutcliffe ... 356,176
Box. See Axle box. Electrical call box. Journal box. Match box. Music box. Paper box.
Bracket. See Sliding bracket.
Brake. See Car brake.
Breast strap slide, A. G. Schlener ... 356,163
Bridge, C. F. T. Kandeler ... 356,283
Bridge, H. Knudson ... 356,407
Bromine and iodine from bittern, extracting, F. C. Phillips ... 356,292
Brush making machine, Price & Sherman ... 356,330
Brushes, manufacture of rotary, B. F. Quinby ... 356,158
Buckle, trace, W. T. Neelands ... 356,154
Bung, M. Schwemberger ... 356,379
Butter jar, L. K. Bryant ... 356,188
Butter wrapper, S. Tilton ... 356,180
Button, G. K. Webster ... 356,386
Button, cuff, F. J Patten ... 356,423
Cab doors and windows, operating, H. C. Sears ... 356,212
Cab, hansom, C. A. Reade ... 356,160
Calculator, J. G. Kurtz ... 356,140
Can filling machine, J. B. Hodapp ... 356,122
Can stopper, automatic, W. H. Thayer ... 356,432
Candy and manufacturing the same, G. D. Moffat 356,394
Car brake, automatic, G. H. Poor ... 356,231
Car coupling, E. McCloskey ... 356,204
Car coupling, G. J. Ferguson ... 356,111
Car coupling, J. J. Kennedy ... 356,320
Car coupling, T. H. & E. V. Snyder ... 356,428
Car door, G. J. Ferguson ... 356,307, 356,308
Car step, U. Beausejour ... 356,346
Carburetor, J. B. Stanour ... 356,337
Carding machine, G. Bebb ... 356,089, 356,090
Carpet stretcher, W. T. Morgan ... 356,417
Carriage, G. H. Morgan ... 356,370
Carriage, child's, W. E. Crandall ... 356,100
Cartridges, packing case for, L. P. Diss ... 356,276
Cash tally, J. C. Fisk ... 356,227
Casting diamond tools, mould for, T. A. Jackson ... 356,132
Chain for transmitting motion, H. P. Mallison ... 356,324
Chair. See Folding chair. Opera or school chair.
Chopper. See Cotton chopper.
Churn, J. N. Draughon ... 356,105
Cigar tip clipper, T. R. Shea ... 356,168
Cigar wrappers and binders, machine for cutting, W. H. Forbes ... 356,113
Cigars, cigarettes, etc., package for, W. H. Emery ... 356,244
Clamp, M. F. Hunt ... 356,315
Clipper, hair, F. M. Washburn ... 356,434
Clothes pin, spring, R. E. Hoyt ... 356,127
Coal elevator, screen, and loader, combined, L. G. Scofield ... 356,165
Coffin platform, S. Baker ... 356,237
Coffins, etc., handle for, A. D. Allen ... 356,184
Collar, horse, W. Hull ... 356,128
Colter, plow, N. R. Doan ... 356,306
Comb graille, J. A. Dorley ... 356,223
Cooling by the use of refrigerating liquids and apparatus therefor, G. Richmond ... 356,210
Coops, warming device for poultry, H. J. Haight ... 356,120
Corset, E. A. Terry ... 356,397
Cotton chopper, Patterson & Webster ... 356,424
Coupling. See Car coupling. Thill coupling.
Cultivator, Blue & Halter ... 356,094
Cultivator, O. L. Neisler ... 356,289
Cultivator adjustable shovel block, H. M. Godfrey ... 356,361
Cultivator and seed drill, combined garden, C. C. Hunter ... 356,129
Cultivator, planter, and harrow, combined, F. M. Dougan ... 356,104
Curtain exhibitor, revolving window, W. P. Yeoman ... 356,219
Curtain fixture, O. F. Mitchell ... 356,369
Curtain rack, W. Meyer ... 356,288
Damper, F. R. Smith ... 356,169
Dental plugger, W. H. Baldwin ... 356,221
Desks, pencil drawer for school, S. A. Perry ... 356,327
Domestic boiler and heating drum, combined, J. W. Barton ... 356,345
Door check, E. Frothingham ... 356,115
Door plate and letter slip alarm, combined, F. Sanderson ... 356,233
Doubling and winding silk, etc., machine for, J. E. Tynan ... 356,216
Draperies, etc., blank for holding ornamental settings for, G. K. Birge ... 356,187
Drill. See Seed drill.
Dust whip, wire, M. C. Buck ... 356,348
Dyestuffs, manufacture of, J. A. Mathieu ... 356,368
Electric accumulator, C. B. De Montaud ... 356,390
Electric arc lights, dash pot for, C. E. Scribner ... 356,211
Electric conductors, conduit system for, J. F. Munsie ... 356,152
Electric conductors, underground conduit for, J. F. Munsie ... 356,151
Electric wire or cable distributing system, J. F. Munsie ... 356,153
Electrical call box, G. S. Nickum ... 356,418
Elevator. See Coal elevator. Hay elevator.
Elevator cable lock, W. S. Morton ... 356,149
Engine. See Gas engine. Hot air engine. Pumping engine. Rotary engine.
Exercising machine, A. H. Howard ... 356,126
Eyeglasses, nose rest for, S. Lubin *et al* ... 356,410
Farm gate, N. G. Swift ... 356,178
Feather trimming and making the same, C. Lachner ... 356,141
Feed water regulator, D. E. Butler ... 356,400
Feed water regulator, S. J. Parker ... 356,373
Fence wires, tool for clinching, H. E. Lambert (r) 10,799
Fertilizer distributer, J. M. Sullivan ... 356,175
Fertilizer distributer and seed planter, D. Morgan 356,259
Fertilizer in rows, apparatus for dropping, J. I. Du Bois ... 356,224
Filter, steam boiler, J. W. Hyatt ... 356,131
Filter, water, R. L. Darragh ... 356,242
Firearm, breech-loading, L. P. Diss ... 356,274
Firearm, breech-loading, C. A. King ... 356,321
Firearm, magazine, J. M. & M. S. Browning ... 356,271
Firearm, magazine, L. P. Diss ... 356,275
Fireplace, J. T. Reaves ... 356,262
Fly frames, bolster for, A. L. Durgin ... 356,194
Fly screen, C. W. Chatterton ... 356,349
Fly trap, window, W. T. Parks ... 356,374
Folding chair, J. E. Wakefield ... 356,218
Frame. See Picture frame.
Furnace. See Hot air furnace. Ore roasting furnace.
Fuse, railway, F. Jordan ... 356,135
Gauge. See Sewing machine gauge.
Garment supporter, G. W. Stewart ... 356,174
Gas, apparatus for generating, A. A. Harwood ... 356,247
Gas engine, F. W. Ofeldt ... 356,419
Gate. See Farm gate. Railway gate. Sliding gate.
Glassware, ornamenting, J. Locke ... 356,409
Glove fastener, S. Florsheim ... 356,310
Glove protector, K. V. Waterhouse ... 356,385
Grain scourer, G. S. Cranson ... 356,273
Grate, B. F. Warren ... 356,433
Guard. See Mower and reaper guard.
Gun lock, E. Schlegelmilch ... 356,378
Gun, magazine, L. P. Diss ... 356,277
Gun, magazine, G. V. Fosbery ... 356,311
Gun, magazine, S. A. Sullenberger ... 356,338
Hair pin, J. H. Russell ... 356,263
Hair spring stud index, C. Teske ... 356,179
Hammer, W. K. Howes ... 356,248
Handcuff, J. J. Tower ... 356,215
Handles, machine for making wire, P. Eley ... 356,195
Harness back band, I. Johnson ... 356,250
Harrow, C. G. Mower ... 356,150
Harvester, grain, J. M. Spangler ... 356,171
Harvesters, twine guide and tension device for, J. H. Rose ... 356,377
Hats or caps, making sweat bands for, A. Morehouse ... 356,416
Hay elevator, P. G. Strickler ... 356,431
Hay loader and stacker, M. C. & J. M. Isom ... 356,316
Heat indicator and distant alarm, automatic, W. Gee ... 356,360
Heel stiffener machine, E. Shaw ... 356,335
Hitching device, horse, E. Davidson ... 356,305
Hoisting and lowering apparatus, A. Ilse ... 356,249
Holder. See Bag holder. Towel or napkin holder.
Hop vine supports, wire holder for, O. M. Knox ... 356,139
Hops, machine for picking and separating, F. Leonard ... 356,323
Hoof pad, R. Shiers ... 356,294
Hook. See Ladder hook. Snap hook.
Horse detacher, L. S. Brown ... 356,097
Horse rake, J. T. Crist ... 356,351
Horseshoe nails, machine for forging, C. R. Ellacott ... 356,391
Hose nozzle, J. H. Parker ... 356,372
Hose reel, G. W. Hannis ... 356,313
Hot air engine, B. F. McKinley ... 356,146, 356,147
Hot air furnace, A. L. Goodenow ... 356,392
Ice machine, D. Smith ... 356,382
Indicator. See Heat indicator.
Insulating electric conductors, W. R. Patterson ... 356,207
Insulating telegraph cables, W. R. Patterson ... 356,156
Iodine from bittern, obtaining, F. C. Phillips ... 356,291
Ironing machine, anti-friction hand, F. Corbett ... 356,240
Jack. See Lifting jack.
Jar. See Butter jar.
Journal bearing, anti-friction, M. Randolph ... 356,331
Journal bearing, M. Randolph ... 356,332
Journal box thrust bearing, G. M. Clark ... 356,099
Jute, wheel or roller for slivering, H. P. Garland ... 356,312
Knit garment, S. B. & F. F. Lewis ... 356,142
Ladder apparatus, fire, D. Barnes ... 356,088
Ladder hook, D. Eaton ... 356,353
Ladder, railway, E. A. Perkins ... 356,375
Lamp, electric arc, A. Harding ... 356,282
Lamp globes, protector for, F. Bredow ... 356,270
Lamp, incandescent electric, W. Holzer ... 356,199
Latch, M. C. Niles ... 356,155
Leather dressing machine, E. A. Curry ... 356,191
Lever for tedders, etc., adjusting, J. E. Offutt ... 356,371
Lifting jack, J. B. Dubler, Sr ... 356,193
Lifting jack, R. F. Norton ... 356,395
Lock. See Elevator cable lock. Gun lock. Nut lock.
Loom for weaving tufted fabrics, A. K. Sherwood ... 356,213
Loom shuttle box operating mechanism, J. Zimermann ... 356,267
Mallet, J. H. Alexander ... 356,299
Match box, R. Heller ... 356,405
Mattress, spring, J. S. Taylor ... 356,339
Metal working machine, compound, H. Goodenow ... 356,118
Mining cage, G. H. Ramsay ... 356,208
Mirror and bedstead, combined, C. Brothers ... 356,303
Mitering machine, M. C. Patrick ... 356,326
Moulds for twisted articles, apparatus for making, G. F. Stearns ... 356,430
Mower and reaper guard, J. H. Folliott ... 356,357
Music box, duplex, A. Junod ... 356,251
Musical instrument, mechanical, R. W. Pain ... 356,422
Nail distributing and driving machine, F. F. Raymond, 2d ... 356,209
Nailing, system of blind, D. M. Balsar ... 356,238
Naphtha engines, pressure generator for, F. W. Ofeldt ... 356,420
Necktie fastener, H. C. Hill ... 356,314
Nut fasteners, machine for making, W. Dunn ... 356,279
Nut lock, W. H. Smith ... 356,170
Oil, treating and refining cocoanut, A. P. Ashbourne ... 356,398
Opera or school chair, M. Donovan ... 356,222
Ore roasting furnace, T. McGinnis ... 356,287
Ores, jigger for separating, F. T. Freeland ... 356,359
Organs, pneumatic motor for, Pain & Tremaine ... 356,421
Oven for tempering wire, etc., E. Clifton ... 356,350
Packing joints and other purposes, composition for, T. McSweeny ... 356,411
Pad. See Hoof pad.
Paint can press, J. M. Mungiven ... 356,205
Painting machine, W. T. Johnson ... 356,201
Pan, dish, or other utensil, A. Bardell ... 356,343
Paper box, G. O. Blowers ... 356,093
Paper fastener, E. Kempshall ... 356,202
Paper, manufacture of waterproof building, I. W. Marshall ... 356,367
Pen, fountain, J. Holland ... 356,123
Percolator, double pressure, E. S. Anderson ... 356,087
Piano action, upright, W. C. Ellis ... 356,109
Piano tuning pin, F. Rahse ... 356,159
Pianos, keyboard attachment for, Wright & Marsden ... 356,236
Pick, A. T. Moats ... 356,412
Picture frame, F. F. Peters ... 356,328
Pin. See Clothes pin. Hairpin. Piano tuning pin.
Photograph burnisher, W. H. Boles ... 356,399
Plant and tree protector, C. Schott ... 356,164
Planting attachment, corn, J. B. Pedrick ... 356,290
Plated goods, manufacturing, A. E. Shader ... 356,234
Platform. See Coffin platform.
Pliers, gas, W. P. Dahl ... 356,241
Plow point, Spaulding & Thistlewood ... 356,172
Plow, revolving, A. F. La Shells ... 356,284
Plumbers' traps, apparatus for making, J. McCloskey ... 356,258
Press. See Paint can press.
Projectile, explosive, C. G. Otis ... 356,396
Protector. See Glove protector. Plant and tree protector. Tree protector.
Pruning shears, J. L. Dufrane ... 356,278
Pump, breast, Van Altena & Vantwoud ... 356,386
Pumping engine, C. A. Hagde ... 356,119
Pumps, motor attachment for centrifugal, B. W. Scott ... 356,264
Putty, device for laying, J. H. Ives ... 356,200
Rack. See Curtain rack. Towel, hat, and paper rack.
Radiator, steam, J. G. Shearlock ... 356,293
Railway crossing, C. R. & H. Johnson ... 356,364
Railway crossings, safety gate for, M. B. Mills ... 356,325
Railway gate, R. C. Elliott ... 356,402
Railway rails, device for securing, H. B. Hall ... 356,404
Railway signal, J. H. Ames ... 356,342
Rain water and filtering the same, intercepting impurities contained in, H. Curzon ... 356,192
Rake. See Horse rake.
Reel. See Hose reel.
Refrigerating cellars and vaults, M. Leavy ... 356,254
Refrigeration, separating ammonium chloride from solutions by, G. Jarmay ... 356,133
Refrigerator, J. P. Emery ... 356,226
Regulator. See Feed water regulator.
Revolver, D. B. Wesson ... 356,387
Roofing, metallic, T. W. Helliwell ... 356,393
Rope splice, A. G. Garfield ... 356,116
Rotary engine, E. Verstraete ... 356,384
Sash fastener, F. D. Livingstone ... 356,143
Sash fastener, J. B. Marshall ... 356,255
Sash fastener, White & Thomas ... 356,182
Sash fastening, S. P. Croswell, 2d ... 356,190
Sash holding device, W. A. Swift ... 356,177
Sawmills, saw catcher for band, G. H. Zschech ... 356,220
Sawing machine, scroll, H. L. Beach ... 356,186
Sawing wooden gutters, machine for, E. E. Elder. 356,280
Scourer. See Grain scourer.
Screen. See Fly screen.
Seat. See Adjustable seat.
Seed drills, attachment for, J. R. Valentine ... 356,340
Separator, T. R. Phillips ... 356,329
Sewing machine, W. A. Mack ... 356,203
Sewing machine, A. Morehouse ... 356,413
Sewing machine gauge, A. Morehouse ... 356,414
Sewing, method of, A. Morehouse ... 356,415
Shears. See Pruning shears.
Shears, W. E. Lant ... 356,253
Shingle, metallic, A. Ricketson ... 356,161
Sliding bracket, gauge, and compass, combined, Shanklin & McNeill ... 356,166
Signal. See Railway signal.
Skiagraph, J. M. Maxwell ... 356,144
Sliding gate, James & Lazenby ... 356,317
Snap hook, J. M. Basinger ... 356,268
Soldering machine, P. Eley ... 356,196
Spark arrester, W. F. Elkins ... 356,243
Speaking tube, E. Becker ... 356,091
Spindle. See Spinning spindle.
Spinning machines, flier for, L. E. Leigh ... 356,229
Spinning machines, flier for, J. A. V. Smith ... 356,336
Spinning machines, etc., saddle for the top rolls of, E. C. Willey ... 356,183
Spinning machines, spindle banding and band tightener for, R. Gemmell ... 356,117
Spinning machines, spindle driving mechanism for, C. H. Fisher ... 356,355
Spinning machines, tightener for spindle bands of, W. & S. Blackburn ... 356,239
Spinning spindle and support therefor, C. H. Fisher ... 356,356
Spittoons, casing for, J. F. Langenberg ... 356,252
Spring. See Wagon spring.
Stamping apparatus, mail, Hey & Laass ... 356,406
Stamping apparatus, mail, Laass & Hey ... 356,228
Stanchion, cattle, E. H. Haley ... 356,281
Stand. See Show stand.
Steam boiler, D. A. Dickinson ... 356,103
Stilt, W. B. Loveland ... 356,366
Stone saw, E. G. Kemper ... 356,136
Stopper. See Bottle stopper. Can stopper.
Store service apparatus, B. C. Algie ... 356,341
Stove, G. E. Sharp ... 356,381
Stoves, attachment for cooking, E. Nifenecker ... 356,260
Studs or hooks, machine for setting lacing, W. C. Bray ... 356,302
Supporter. See Garment supporter.
Switch. See Three-throw split switch.
Switch board systems, test circuit for multiple, C. E. Scribner ... 356,425
Switch board test circuit, multiple, C. E. Scribner 356,426
Syringe, J. C. Baker ... 356,185
Table. See Turntable.
Table sink, T. M. Dils ... 356,401
Tags, machine for stringing, C. H. Dana, Jr ... 356,101
Target, flying, F. Erb, Jr ... 356,354
Target trap, flying, C. Swan ... 356,297
Teaching fractions, device for, F. B. Shannon ... 356,167
Telegraph cables, manufacture of, W. R. Patterson ... 356,206
Telephone exchange, factory, C. E. Scribner ... 356,427
Telephone receiver, E. T. Gilliland ... 356,197
Telephone system, A. M. A. Beale ... 356,300
Thill coupling, H. D. Brown ... 356,304
Thrashing machine, J. F. Hanson ... 356,121
Three-throw split switch, C. A. Lehman ... 356,365
Timepieces, escapement for, Clay & Hanson ... 356,189
Tongue, vehicle, H. W. Pratt ... 356,232
Tool, routing, H. F. Stearns ... 356,429
Towel, hat, and paper rack, combined, E. L. Scribner ... 356,380
Towel or napkin holder, W. C. Dufeu ... 356,225
Traction engines, steering apparatus for, J. F. Smith ... 356,265
Trap. See Ant trap. Fly trap. Target trap.
Tree protector, F. R. Woodward ... 356,389
Tricycle, G. E. Whitmore ... 356,388
Trimmer. See Wick trimmer.
Trowel or scoop, A. Bardell ... 356,344
Tube. See Speaking tube.
Tug, hame, S. B. Davis ... 356,102
Turntable, F. H. Saylor ... 356,162
Type writing machine, Greene & Smith ... 356,245
Valve, balance, J. T. Merrill ... 356,148
Valve, balance slide, W. J. Stevens ... 356,173
Valve mechanism for compound engines, F. M. Rites ... 356,376
Valve, pressure regulating, F. A. Jones ... 356,318
Vehicle running gear, J. J. Fetzer ... 356,309
Vehicle running gear, D. A. Sprague (r) ... 10,800
Vehicle, two-wheeled, I. N. Fanebust ... 356,110
Vehicle wheel, R. M. Suratt ... 356,383
Voltaic battery, primary, J. E. Pearce ... 356,261
Wagon bodies from the running gear, device for lifting, W. A. Pipher ... 356,157
Wagon, dumping, R. H. Branch ... 356,269
Wagon spring, L. Fracher ... 356,358
Walls, decorating, McDonnell & Mallen ... 356,230
Wardrobes, clothes rack for, H. T. Holghalb ... 356,125
Washing machine, J. C. McCandliss ... 356,257
Watch, stem winding and setting, G. F. Johnson ... 356,134
Watch, stop, A. F. Goy-Blanc ... 356,362
Water wheel, turbine, P. H. Holmes ... 356,124
Wheel. See Vehicle wheel. Water wheel.
Whip, E. K. Warren ... 356,181
Whip button and method of manufacture, C. G. Becker ... 356,092
Wick trimmer, H. Jordan ... 356,319
Windmill, A. L. & D. M. Kitselman ... 356,137
Windmill, A. W. McKenzie ... 356,145
Windmill attachment, Greenwood & Hill, Jr ... 356,246
Windmills, automatic regulator for, H. R. Stephens ... 353,295
Wire box and cover fasteners, machine for making, J. Adt ... 356,298
Wire fabric machine, A. L. Kitselman ... 356,322
Wire rope, socket for fastening, F. C. Dumas ... 356,106
Wood, machine for cross cutting, F. Mankey ... 356,286
Writings, etc., reproducing, O. Steuer ... 356,206
Zylonite, apparatus for working, J. B. Edson ... 356,108

DESIGNS.

Bracelet, H. C. Lindol ... 17,070
Dishes, ornamentation of, C. E. Haviland ... 17,068, 17,069
Easel, E. B. Crocker ... 17,066
Stove or range, cooking, G. E. Wilbur ... 17,071
Type, font of printing, G. F. Giesecke ... 17,067

TRADE MARKS.

Bitters, Picon & Co ... 13,993
Blacking, shoe, Societe Generale des Cirages Francais ... 13,996
Cigarettes, Silverberg & Co ... 13,995
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Eye salves, T. Nairn ... 13,991
Grinding mills, portable, P. Hobler ... 13,988
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Stationery, various articles of, J. C. Blair ... 13,985
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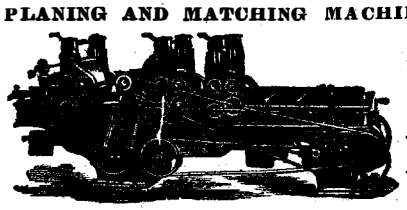
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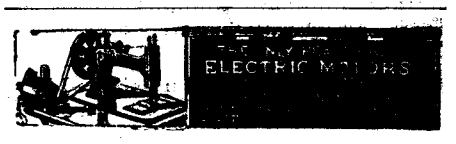

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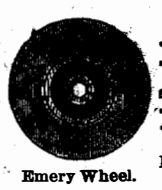

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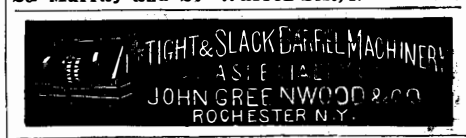

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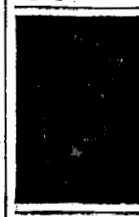

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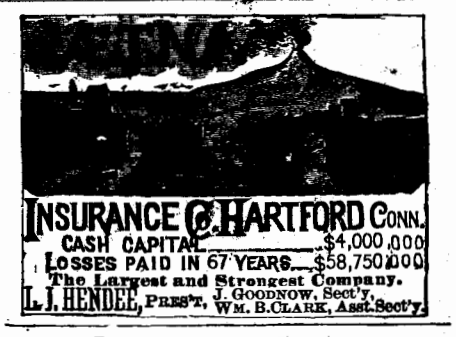
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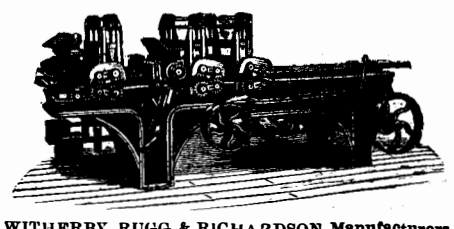

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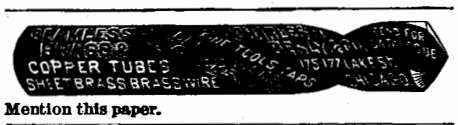

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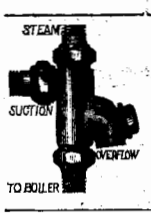

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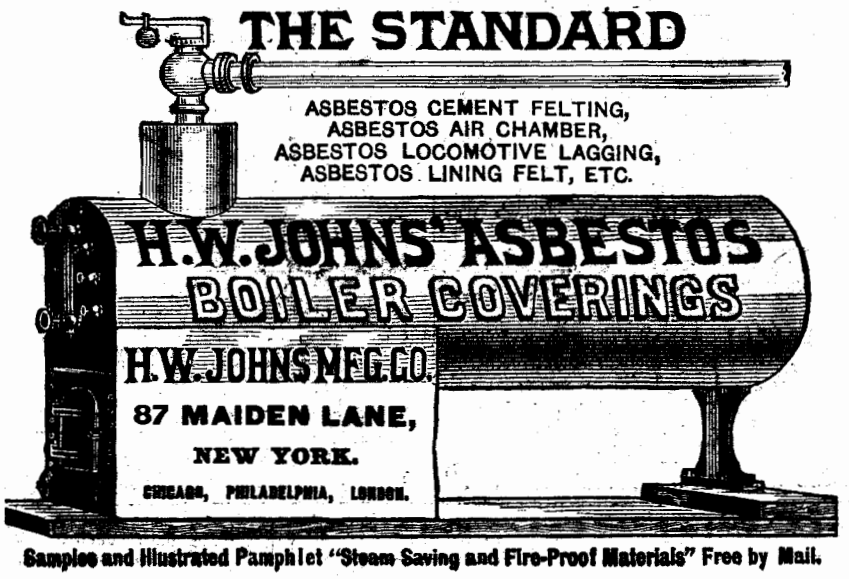

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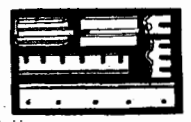

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